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THE AUSTRALASIAN FROGS OF THE FAMILY LEPTODACTYLIDAE

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(With one plate and twenty text-figures.)

THE first frog of this family to be named and described was the *Rana australiaca* of Shaw, which was renamed *Rana spinipes* by Schneider a few years later. The first to be referred to a definite family was *Crinia georgiana* Tschudi, described in 1838 and placed by its describer in the family Cystignathi. As additional species were discovered in later years they were referred to an ever-increasing number of families according to the views of the times, and it was not until 1865 and 1868 when Cope published his papers on the classification of the Anura that our present system began to take shape. Cope's disposition of the genera known to him (1865, 1866*a* and *b*) was :—

Bufonidae

Asterophryinidae

Cystignathi

Pseudes

Ceratophydes

Crinia

Chelydobatrachus (= *Myobatrachus*).

Pseudophryne

Cryptotis (= *Adelotus*)

Mixophyes

Chiroleptes (= *Cyclorana*)

Crinia

Hyperolia (= *Uperoleia*)

Helioporus

Neobatrachus (= *Helioporus*)

Borborocastes (inc. *Limnodynastes*)

Boulenger's classification in the Catalogue (1882) differed but slightly from this; the various subfamilies of Cystignathi were dropped and *Cryptotis* was also included in this family, renamed Cystignathidae; *Notaden* was added to the Bufonidae and the newly described *Batrachopsis* (= *Lechriodus*) was referred to the family Pelobatidae. The propriety of retaining the toothless forms in a family (Bufonidae) distinct from the toothed genera (Cystignathidae) was criticized from time to time, but Boulenger's arrangement persisted until 1922 when Noble, following up an earlier piece of work by Nicholls (1916), advocated the union of the Cystignathidae and Bufonidae under the latter name and the transference of *Lechriodus* to this family from the Pelobatidae. Later (1931) the same author modified this arrangement by subdividing the Bufonidae into a number of subfamilies, to one of which, the Criniinae, all the Australasian genera were referred.

It was admitted that this subfamily was but poorly defined, and could hardly be satisfactorily differentiated from some of the Neotropical groups of the same family.

Noble's conception of the "Bufonidae" has not met with universal approval, and herpetologists in general have shown a tendency to subdivide it into two, Bufonidae (corresponding to Noble's subfamily Bufoninae) and Leptodactylidae (s. Cystignathidae or Ceratophryidae), containing his subfamilies Criniainae, Heleophryninae, Rhinophryninae, Pseudinae (= Ceratophryinae Parker, 1935), Elosiinae and Leptodactylinae. But the principle of brigading the Australasian genera with others from the Neotropical region and from South Africa as one large family has not been seriously criticized.

It has long been realized that the limits and mutual relationships of the Australian genera were very inadequately understood, and the present work is an attempt to remedy this deficiency in so far as it is at present possible. More and larger collections are still required and much more detailed anatomical work is still necessary. But a larger amount of material has been available to the present author than to any other previous worker (nearly 1300 specimens, including types of 59 names), and its study has emphasized the necessity for a reconsideration of a number of previously accepted beliefs. As far as the family and subfamily status is concerned, it has become clear that the Australasian genera fall into two groups, not absolutely differentiated, but tending to grade into one another and confined to that zoogeographical region. They have been given subfamily status and are referred to in the following notes as the Cyclorantinae and Myobatrachinae. These names have been selected in accordance with the principles laid down in Articles 4 and 5 of the International Rules of Zoological Nomenclature (cf. Parker, 1934 : 15). The first genus of the former subfamily whose name was made the basis of a family or subfamily name was *Chiroleptes* (Chiroleptina Mivart, 1869); this generic name unfortunately has to be displaced by *Cyclorana* and the subfamily name must be changed accordingly (Art. 5). The name Myobatrachinae, from Myiobatrachina Bonaparte, 1850, long antedates the name Criniainae used by Noble (from Crinia Cope, 1866).

The relationships of these two Australian subfamilies to the South African and Neotropical members of the Leptodactylidae cannot be satisfactorily discussed until a comparative survey of the whole family has been completed. Their mutual relationships can best be considered after a brief survey of the various anatomical and morphological characters by which they are characterized.

Internal Cranial Morphology.—This has only been studied in a single species, *Crinia georgiana* (du Toit, 1934). During recent years a good deal of attention has been directed by morphologists and anatomists to the cranial morphology of the Anura and attempts have been made to modify the existing scheme of classification on their findings. But it must be stressed that far too few species have yet been examined for any satisfactory generalizations to be possible and the variability of many of the characters has not been investigated. Du Toit gives the following summary of characters noticed in *Crinia georgiana* :—

- (1) The alary forms the lateral support of the entire lateral wall of the apertura externa and vestibulum.
- (2) The crista subnasalis is absent.
- (3) The anterior undivided part of the crista intermedia is much bigger than in *Rana*.
- (4) The posterior vestibular "wulst" is absent.
- (5) The plica obliqua is suspended from the tectum nasi.

- (6) The infundibulum possesses an extra antero-ventral extension.
- (7) A well developed recessus sacciformis is present.
- (8) The cavum medium, being more posteriorly situated than in the European *Rana*, does not share in the formation of the recessus sacciformis.
- (9) The ductus nasolacrimalis opens into the roof of the horizontal part of the infundibulum.
- (10) The recessus lateralis attains an enormous size.
- (11) The plica isthmi is absent.
- (12) The intermaxillary gland opens into the buccal cavity by two main ducts only.
- (13) The septomaxillary consists of an anterior unpaired portion which has two posteriorly-directed processes.
- (14) The connective tissue between the latter bone and the lamina inferior tends to disappear.
- (15) The vomer (prevomer) is divided, consisting of an anterior edentulous and a posterior dentigerous portion.
- (16) The os en ceinture is paired.
- (17) The foramen for the IVth nerve is situated in front of the foramen opticum.
- (18) The arteria carotis cerebialis enters the skull through a separate foramen.
- (19) The foramen perilymphaticum superius does not communicate with the jugular foramen.
- (20) The fronto-parietal fontanelle is large.
- (21) There is only one dorsal fenestra in the chondocranium.
- (22) The annulus tympanicus is sickle shaped.
- (23) The hyomandibular branch of the trigeminal nerve is ventrally situated to the plectrum.
- (24) The posterior part of the operculum is weakly perichondrally ossified.
- (25) The articular region differs from that of *Rana*.
- (26) *Crinia* possesses a bursa angularis oris.
- (27) The hyale is confluent with the otic capsule.

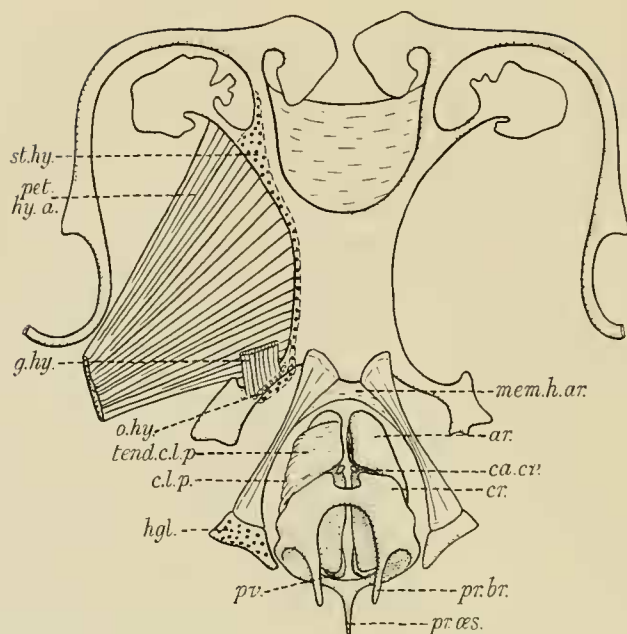
Many of these characters are of widespread occurrence throughout the Anura and can have little or no taxonomic importance, but others again (e.g. 23) may be peculiar to the species or genus. Those which have been investigated in more than one species of the subfamilies under consideration will be considered separately.

Premaxillae.—These show no great diversity of structure; they are dentigerous in the Cycloraniinae except *Notaden*, but are edentulous in *Uperoleia* (part), *Metacrinia*, *Glauertia* (part), *Pseudophryne* and *Myobatrachus* of the other subfamily. In males of *Adelotus* the teeth are somewhat enlarged.

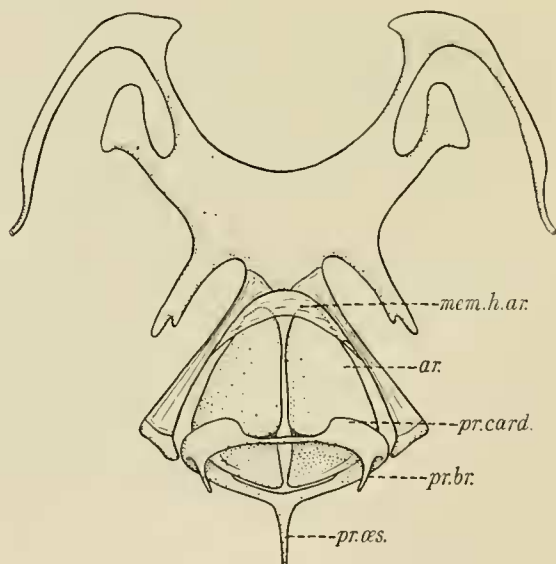
Maxilla.—This bone is usually deeper than normal in the Cycloraniinae where it is dentigerous except in *Notaden*; in some species of *Cyclorana*, notably *C. australis*, its outer face is heavily sculptured. In the Myobatrachinae the bone is relatively less deep and is toothless in those genera where the premaxilla is also edentulous (*q.v.*).

Septomaxillary.—Apparently present in all genera of both subfamilies; its variation has not been investigated.

Prevomer.—In the Cycloraniinae this bone is large and entire with a strong posterior portion bearing teeth (text-figs. 4-9). In the Myobatrachinae, however,

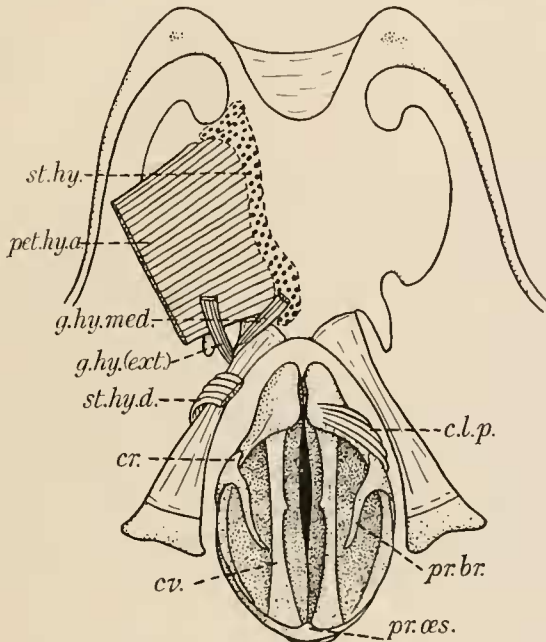


TEXT-FIG. 1.—Hyoid and larynx of *Heleioporus albopunctatus* (after Trewavas). *ar.* = arytaenoid; *ca.cv.* = cartilage of vocal chord; *c.l.p.* = posterior constrictor laryngis; *cr.* = cricoid; *g.hy.* = genio-hyoid muscle; *hgl.* = hyoglossus muscle; *mem.h.a.* = hyo-arytaenoid membrane; *o.hy.* = omohyoid muscle; *pet.hy.a.* = anterior petrohyoid muscle; *pr.br.* = bronchial process; *pr.oes.* = oesophageal process; *p.v.* = pulvinar vocale; *st.hy.* = sternohyoid muscle; *tend.c.l.p.* = tendon of posterior constrictor laryngis.



TEXT-FIG. 2.—Hyoid and larynx of *Limnodynastes peronii* (♀) (after Trewavas). *pr.card.* = cardiac process. Other abbreviations as in text-fig. 1.

it is greatly reduced in size, is often divided into two, with the posterior, primitively dentigerous, portion disappearing and teeth vestigial or entirely absent (text-figs. 13-15). In this latter subfamily a transitional series can be traced from species such as *Crinia laevis*, in which vomerine teeth are still present and the bone is entire (text-fig. 14), to forms such as *Pseudophryne*, in which both the anterior and posterior portions may be completely lost. But in no member of this subfamily is the bone as large, or the teeth as numerous, as in any member of the Cyclorantinae. There is no absolute correlation between loss of maxillary and vomerine teeth. In the Cyclorantinae maxillary teeth are lost only by *Notaden*, where vomerine



TEXT-FIG. 31.—Hyoid and larynx of *Crinia signifera* ♂. Membranous wall of larynx removed, but vocal chords left in place. (After Trewavas.) *cv.* = vocal chord; *g.hy.med.* = median geniohyoid muscle; *st.hy.d.* = dorsal part of sternohyoid muscle. Other abbreviations as in text-fig. 1.

teeth persist; in the Myobatrachinae vomerine teeth are absent in *Uperoleia rugosa* whilst maxillaries still persist. There does appear, however, to be a correlation between the vomerine condition and the tongue, with which also the hyoid and intermaxillary glands are related (*q.v.*). Teeth, in order to function, need a firm surface to bite on. In the case of the vomers this surface is the tongue, and consequently it is not surprising to find that where the tongue is large and broad, as in the Cyclorantinae, the vomers are well developed, whereas in the Myobatrachinae, which all have a much smaller, narrow tongue, the vomerine teeth are obsolescent. It has been noticed in the Microhylidae (Parker, 1934 : 6) that there is a similar correlation between the presence of a large broad tongue and an unreduced prevomer.

Palatine.—This bone is present throughout both subfamilies and shows no important variation.

Ethmoid.—This bone is entire in the Cyclorantinae, but may be divided, as in

¹ Text-figs. 1-3 reproduced by permission of the Royal Society of London.

the family Microhylidae, in some members of the Myobatrachinae, e. g. *Uperoleia*, *Pseudophryne* and *Crinia*. Not infrequently it is continued forwards as a perichondral ossification in the tectum, solum and septum nasi (cf. *Cyclorana australis*, text-fig. 5).

Fronto-parietals.—In the majority of the genera of both subfamilies these bones are very small, laterally disposed and widely separated from one another. In *Cyclorana*, *Lechriodus*, *Mixophyes* and *Adelotus* of the one subfamily they form a median suture, but in the Myobatrachinae the genus *Uperoleia* alone lacks a fronto-parietal foramen.

The Lower Jaw.—Shows no important modifications except in the genus *Adelotus* where a pair of very large, tusk-like odontoids are developed anteriorly in the male sex. The function of these structures is not known, but it is interesting to note that a similar development has occurred in certain African Ranids (*Dimorphognathus*, *Petropedetes* and *Phrynodon*) and in some Asiatic species of the genus *Rana*.

Hyoid and Larynx.—These structures have been fully investigated by Trewavas (1933), but in only a limited number of species—*Heleioporus albopunctatus*, *Limnodynastes peronii*, *Crinia signifera* and *Mixophyes fasciolatus*. When due allowance is made for the fact that the only specimen of the latter species which was examined was a juvenile, it appears that these four species fall into two clearly-definable groups, corresponding to the two subfamilies, and characterized thus :

A. Cyclorantinae (*Heleioporus*, *Limnodynastes* and *Mixophyes*).

- (1) Alary process narrow proximally, but expanded distally (text-figs. 1 and 2).
- (2) Cricoid complete.
- (3) Oesophageal process of the cricoid more or less slender.
- (4) M. omohyoideus present.
- (5) Mm. sternohyoideus and petrohyoidei attached at the lateral edges of the hyoid plate.

B. Myobatrachinae (*Crinia*).

- (1) Alary process of the hyoid a wing-like expansion of almost the whole lateral margin of the hyoid plate, without narrow stalk (text-fig. 3).
- (2) Cricoid incomplete.
- (3) Oesophageal process of the cricoid broad and short, or almost absent.
- (4) M. omohyoideus absent.
- (5) Mm. sternohyoideus and petrohyoideus anterior inserted on the ventral surface of the hyoid, reaching the middle line in the posterior part of this insertion.

Certain of these characters, notably the loss of the omohyoideus and the division of the cricoid, are believed to have little taxonomic significance for they occur many times in the Anura in completely unrelated forms, but the shape of the alary processes and the attachment of the sternohyoideus and petrohyoidei appear to be correlated with other characters and may have considerable taxonomic value. Thus the broad wing-like, sessile alary process is found in all the Myobatrachinae (*Uperoleia*, *Crinia*, *Metacrinia*, *Glauertia*, *Pseudophryne* and *Myobatrachus* examined), whilst the pedunculate type is common to all the Cyclorantinae (*Cyclorana*, *Lechriodus*, *Mixophyes*, *Limnodynastes*, *Heleioporus*, *Philoria*, *Adelotus* and *Notaden* examined).

All the genera appear to lack the apical cartilage which is a characteristic feature of most Ranids and Rhacophorids.

Ear.—This organ is present and well developed in all the genera of both subfamilies except *Pseudophryne*, where the tympanum, annulus tympanicus, cavum tympani, columella (plectrum) and Eustachian tube are absent. This condition of the auditory apparatus occurs in many unrelated genera of the Anura so that too great reliance cannot be placed upon it as a guide to phylogeny. The facts that this condition is normal in the Urodela and that the fully-developed anuran ear passes through a similar stage in its ontogeny¹ suggest that the condition may be a primitive one, and it is possible that its sporadic reappearance in so many unrelated Anuran genera is a manifestation of a neotenic tendency.

The external and middle ear show some variations in different genera. The annulus tympanicus is generally incomplete dorsally; in the highly modified burrowing genera there is a tendency for the extra-plectal (columellar) cartilage to increase in size, and in *Myobatrachus* it forms a large thickened pad, as large as, and closely apposed to, the whole of the tympanum. The size and distinctness externally (due to thinning of the overlying skin) of this latter organ are very variable, the general tendency being towards smaller tympana, more deeply seated (partly covered by the m. depressor max. inf.) and protected by thickened skin in cryptozoic forms.

Tongue.—This organ is either subcircular or very broadly oval in the Cyclorhinae, or relatively long and narrow, sometimes quite small, in the Myobatrachinae. These two types of tongue are associated with a different disposition of the openings of the intermaxillary glands (*q.v.*), and also with those differences in the hyoid and prevomer which have already been mentioned. It seems highly probable that all these differences are intimately correlated and that they are concerned with the method of feeding. There appear to be no essential differences in the nature of the food taken by the two subfamilies; in fact the most specialized genera of each, *Notaden* and *Myobatrachus* respectively, parallel one another closely, for both are essentially myrmecophagous and specially adapted for life in termitaria. Yet *Notaden* has a broad, subcircular tongue, vomerine teeth, a long series of ducts from the intermaxillary gland, long, pedunculate alary processes of the hyoid and sternohyoideus and petrohyoideus muscles attached laterally to the hyoid plate, whereas in *Myobatrachus* the tongue is a small, narrow organ, and all the associated structures of the hyoid region and intermaxillary gland are concentrated towards the middle line, and vomerine teeth are wanting. The prey appears to be the same in both genera, yet the mechanism by which it is captured is very different.

Intermaxillary Gland.—E. Müller (1932) has given a general account of the disposition of these glands and their ducts in the Anura and has classified them into five main groups. Representatives of only three genera of the present subfamilies were examined by him, *Pseudophryne*, *Limnodynastes* and *Uperoleia*, and he notes that these three fall into two groups. In *Uperoleia* and *Pseudophryne* the openings of the gland are concentrated near the centre line into two ducts, whereas in *Limnodynastes* the openings of the gland are numerous (14) and form an irregular, transversely oval patch, occupying a space almost equal to the inter-choanal width. A survey of the gland in almost every species of the two Australian subfamilies lends no support to Müller's classification into five main categories, but shows that there is, as might have been expected, a distinct correlation between

¹ du Toit and de Villiers, 1932, *S. Afr. J. Sci.*, 29 : 449-465.

the disposition of the ducts and the shape of the tongue. The function of the gland being to furnish the sticky secretion which enables the tongue to pick up food, a broad tongue will need a widely spread series of ducts for the even distribution of the secretion over its tip, whilst with a narrow tongue a corresponding concentration of the ducts towards the centre-line is essential for efficiency. This is what obtains in fact. In the broad-tongued Cyclorantinae there are numerous ducts arranged in a more or less regular transverse series over a width almost, or quite, equal to the interchoanal space. Sometimes they form a regular, continuous linear series which may even open under a single long fold of the mucous membrane; more frequently, however, they are arranged in three groups on a transverse line, but every gradation between the two extremes can be found. In the Myobatrachinae there are never more than two ducts, opening close together near the middle line, and not infrequently the two open under a common fold which results in the opening appearing single; both conditions may be found within the one species.

Shoulder Girdle.—This structure is relatively stable in the arciferal families, as compared with the firmisternal, where reduction or loss of the clavicle and procoracoid has taken place on numerous occasions. In the Australian Leptodactylidae very few important structural differences have been noticed. Clavicles, procoracoids and coracoids are invariably present and well developed; the omosternum may be absent, but when present is always small and cartilaginous; the sternum also is never ossified, though in old individuals of some of the larger forms there may be some degree of calcification. *Myobatrachus* alone shows any great divergence from the normal, and here there seems to have been a strengthening of the girdle against lateral compression by a broadening of the clavicles and the procoracoid region, whilst the coracoids have assumed a more oblique position and are scarcely larger or stouter than the clavicles (text-fig. 20). The modification recalls, though to a less extent, the conditions to be found in the African Ranid *Hemisus* which is also a cryptozoic genus. A secondary result of the widening of the mesial ends of the clavicles and procoracoids is that the epicoracoids meet edge to edge for about a third of their length and so approach an arcifero-firmisternal condition.

In *Crinia*, and especially in *Crinia haswelli* (text-fig. 15a), the procoracoids extend anteriorly beyond the clavicles, and their form strongly suggests that the omosternum is homologous with the anterior portion of these cartilages. Anatomists cannot agree as to the homologies of this structure in the Anura (de Vos, 1938 : 56), but it seems highly improbable that they are correct in believing it to be of different origin in various species of the same genus.

Vertebral Column.—As in most of the arcifera the vertebrae are pro-coelous, but a peculiar and primitive feature of both subfamilies is the incomplete fusion of the intervertebral condyle with the vertebra and the partial persistence of the notochord; in *Cyclorana* and *Lechriodus* only is the notochord completely lost and the condyle firmly ankylosed to the vertebra. The normal number of 8 presacral vertebrae is found throughout the Myobatrachinae, but in the Cyclorantinae fusion of the first and second vertebrae occurs in five genera—*Limnodynastes*, *Heleioporus*, *Philoria*, *Adelotus* and *Notaden*. The sacral diapophyses are somewhat dilated in all the genera examined, except *Mixophyes*, and the urostyle articulates by two condyles.


Thigh Muscles.—The disposition of the muscles of the thigh, and particularly the relation of the distal tendon of the m. semitendinosus to the mm. graciles, has been shown (Noble, 1922) to be of considerable assistance in elucidating

anuran relationships. In all the Procoela it has been claimed that the semitendinosus is separate from the sartorius and that its distal tendon is either ventral to, or very rarely pierces, the gracilis major and g. minor. It is within the present subfamilies that the rarer condition has been reported. In *Limnodynastes ornatus* the tendon of the semitendinosus pierces the actual gracilis major and minor muscles, and in *Pseudophryne australis* a further stage in the inward migration of the tendon is found, where it perforates, not the muscles themselves, but their ligamentous head. The examination of further material reveals that the inward migration of the tendon of the semitendinosus progresses ever further, and that in the final stages it has passed dorsal to the gracilis entirely, and so attained the condition hitherto regarded as characteristic of the diplasiocoelous firmisternia. In the two subfamilies a complete gradation from one extreme to the other can be traced, but the ventral, presumably more primitive, condition is only found in the Cyclorantinae, whilst the dorsal condition is confined to the Myobatrachinae. The various conditions can be roughly subdivided and classed into four groups thus :

	Genus.	Species.	Subfamily.
I. Distal tendon of the semitendinosus passing ventral to the graciles	<i>Heleioporus</i>	<i>pictus</i>	Cyclorantinae.
		<i>australis</i>	
	<i>Mixophyes</i>	<i>fasciolatus</i>	
	<i>Cyclorana</i>	<i>albopunctatus</i>	
		<i>australis</i>	
		<i>platycephalus</i>	
	<i>Limnodynastes</i>	<i>dorsalis</i>	
		<i>olivaceus</i>	
		<i>peronii</i>	
		<i>salmini</i>	
II. Distal tendon of the semitendinosus perforating the gracilis complex		<i>tasmaniensis</i>	Cyclorantinae.
	<i>Notaden</i>	<i>bennetti</i>	
		<i>nichollsi</i>	
	<i>Limnodynastes</i>	<i>ornatus</i>	
	<i>Lechriodus</i>	<i>melanopyga</i>	
		<i>platyceps</i>	
		<i>fletcheri</i>	
	<i>Adelotus</i> ¹	<i>brevis</i>	
	<i>Uperoleia</i>	<i>marmorata</i>	
	<i>Crinia</i>	<i>georgiana</i>	
III. Distal tendon of the semitendinosus perforating the ligamentous head of the graciles		<i>signifera</i>	Myobatrachinae.
		<i>laevis</i>	
		<i>tasmaniensis</i>	
	<i>Pseudophryne</i>	<i>australis</i>	
		<i>bibroni</i>	
IV. Distal tendon of the semitendinosus passing dorsal to the graciles		<i>coriacea</i>	Myobatrachinae.
	<i>Glauertia</i>	<i>orientalis</i>	
	<i>Glauertia</i>	<i>russelli</i>	
	<i>Metacrinia</i>	<i>nichollsi</i>	
	<i>Myobatrachus</i>	<i>gouldii</i>	

¹ Noble, 1922, classes this species under the following section, but the examples examined by the author show it to have a thigh-muscle complex very similar to that of *Uperoleia*.

Pectoral Muscles.—Jones (1933) has investigated the pectoral musculature of *Cyclorana australis*, *Limnodynastes tasmaniensis*, *L. peronii* and *Uperoleia marmorata* in a survey of the pectoral myology of the Salientia. He finds that the supracoracoideus profundus, found in all these four species, is characteristic of the arcifera. The episternohumeralis, a variable muscle in the firmisternia, is also present in the four Australian species as well as in all the other arcifera except the genera *Bufo* and *Rhinophrynus*. The sternoepicoracoideus, a new muscle, is found in *Cyclorana* and *Limnodynastes* but is absent from *Uperoleia*. In *Cyclorana* it arises from the antero-lateral edge of the sternum and is inserted by a narrow tendon into the dorsal surface of the epicoracoid; similar conditions are reported in the Discoglossidae and South American Leptodactylidae (*Pleurodema*). In the two species of *Limnodynastes* it arises partly from the first myocomma of the rectus abdominis as well as the sternum and so approaches the condition noted in the genus *Hyla* (*H. arborea* and *H. rubra*), where the muscle arises from the myocomma only.

Pupil.—A good deal of confusion has been caused at various times through incorrect descriptions of pupil-shape. This is usually to be accounted for by preservation, the degree of contraction, or distortion having masked the true shape. In the majority of genera of both subfamilies the shape appears to be , but irregularities of contraction may result in either the ventral or lateral angles becoming unduly emphasized. In *Mixophyes* alone is it truly a vertical ellipse.

Viscera.—Hoffman (1931) has described certain features of the viscera, e.g. disposition of lungs, liver-lobes, relations of stomach to duodenum, and the arrangement of the rugae of the lining of the intestinal canal in *Crinia georgiana*. An attempt is made to utilize some of these characters in distinguishing the South African genus *Heleophryne* from the Cystignathidae (Leptodactylidae), but too little is at present known of the variability of these organs for it to be possible to assess their taxonomic value.

Consideration of these facts makes it evident that the two subfamilies are clearly differentiated by the tongue and the associated structures such as prevomers, vomerine teeth, the hyoid apparatus and intermaxillary glands. Other associated characters, such as the vertebral condition and the thigh muscles, also lend support to the view that the two groups represent different evolutionary lines. But in these latter characters and in others, there is a complete intergradation between the two, suggesting a not very remote common ancestry. It is, of course, conceivable that the Myobatrachinae are not a natural assemblage, but are a group of forms derived from the Cyclorantinae by the evolution of the same type of feeding-mechanism on more than one occasion. If the feeding-mechanisms of the two were intimately associated with different foods such a view might have something to recommend it; but in fact no such difference appears to exist and, as has already been pointed out, representatives of each group (*Notaden* and *Myobatrachus*) appear to live under very similar conditions. Unfortunately there is no evidence other than the morphological which will assist in elucidating the relationships of the two subfamilies to one another and to the rest of the Anura. The only fossils known which might throw any light on the subject are the Eocene frogs of the Intertrappean beds of Bombay which have been variously referred to *Rana*, *Oxyglossus* and *Indobatrachus*. If Noble's interpretation (1930) be correct, then *Indobatrachus* should be referred to the Myobatrachinae; it appears to have 8 presacral vertebrae, with the notochord persistent, and vomerine teeth in very small groups, arguing a reduced prevomer. Unfortunately, as in most fossil frogs,

the difficulties of correct interpretation are very great, so that the reference of this fossil genus to the Myobatrachinae must be regarded as somewhat uncertain, and it provides no clue to the relationship of this subfamily with the Cyclorantinae. If correctly referred it indicates that the subfamily persisted in the Oriental region long after the Australian members of the same group had become isolated, and provides additional evidence, if such be necessary, that the whole family Leptodactylidae at one time had a more northerly distribution.

The descriptive methods and terminology used in the following pages conform to standard practice. The dimensions given are for the most part maxima, since, with animals which continue to grow after the attainment of sexual maturity, it is not practicable to give the actual range of adult size with any accuracy. Only when size has been invoked as a specific or subspecific criterion has an attempt been made to give ranges and means. In these instances the ranges are based on obvious adults, i.e. females with distended ovaries containing pigmented ova and males with secondary sex-characters. Such a series will naturally contain a greater proportion of old individuals than of those which have only just reached maturity, and consequently both the range and mean will err on the large side.

Only very approximate geographical ranges are given, though no doubt much interesting information would be forthcoming were the geographical ranges of the various species to be plotted and compared with maps showing climatological, botanical, physiographical, geological and other data. But such maps, to be of value, must be accurate and reasonably complete—criteria which cannot at present be fulfilled even approximately.

During the course of this work so many herpetologists have assisted with advice, information or material that to thank them all individually would need too great a space, whilst to select a few would be invidious. It is, however, essential to proffer thanks to Professor G. E. Nicholls, to whom modern amphibian taxonomy owes so much. The collections he made in West Australia and presented to the British Museum provided the focal point for much of the work, and arguments and discussions with him have given the author numerous pointers and saved him from many egregious errors. The bulk of the material, other than that in the British Museum, has been received from the Museums in Amsterdam, Harvard, Leiden, Perth (W.A.), Stockholm and Sydney; to the authorities in these institutions the author wishes to express his great indebtedness.

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Subfamily CYCLORANINAE.

- RANIFORMES (part) Duméril & Bibron, 1841, *Erpét. Gén.*, 8 : 317.
 RANAE (part) Fitzinger, 1843, *Syst. Rept.* : 31.
 CYSTIGNATHIDAE (part) + DISCOGLOSSIDAE (part) + ALYTIDAE (part) Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 26, 34, 37.
 ASTEROPHRYDIDAE (part) + SCAPHIOPODIDAE (part) + CYSTIGNATHIDAE (part) Cope, 1865, *Nat. Hist. Rev.*, n.s. 5 : 97-120.
 ASTEROPHRYDIDAE (part) + CYSTIGNATHIDAE, PSEUDES (part) + CYSTIGNATHIDAE, CERATOPHRYDES (part) + CYSTIGNATHIDAE, CRINIAE (part) Cope, 1866, *J. Acad. nat. Sci. Philad.*, (2), 6 : 67-97.
 RANIDAE (part) + DISCOGLOSSIDAE (part) + ALYTIDAE (part) Steindachner, 1867, *Reise Novara, Zool., Amph.* : 7-34.
 CYSTIGNATHIDAE (part) Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, 18 : 343.
 CYSTIGNATHIDAE (part) + DISCOGLOSSIDAE + ALYTIDAE (part) Keferstein, 1868, *Arch. Naturgesch.*, 34 : 251-273.
 ALYTIDAE, UPEROLIINA (part) + RANIDAE, CYSTIGNATHINA (part) + DISCOGLOSSIDAE, CHIROLEPTINA (part) and ASTEROPHRYDINA (part) Mivart, 1869, *Proc. zool. Soc. Lond.* : 288-294.
 CYSTIGNATHIDAE (part) + BUFONIDAE (part) + PELOBATIDAE (part) Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 183-432.
 BUFONIDAE (part) Noble, 1922, *Bull. Amer. Mus. nat. Hist.*, 46 : 1-87.
 CERATOPHRIIDAE (part) + BUFONIDAE (part) Waite, 1929, *Rept. Amph. S. Australia* : 244-266.
 BUFONIDAE, CRINIINAE (part) Noble, 1931, *Biol. Amph.* : 496.
 LEPTODACTYLIDAE (part) Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 8.

Tongue broadly oval or subcircular, large. Intermaxillary glands with numerous ducts arranged either in a long, transverse, linear series or in a transversely oval patch or in three groups on a transverse line. Prevomer always present, entire and well developed, with its posterior process bearing a long series of teeth (text-figs. 4-9). Alary processes of the hyoid pedunculate (text-figs. 1-2); sternohyoid and petrohyoid muscles attached to the lateral edges of the hyoid plate. Distal tendon of the m. semitendinosus usually passing ventral to the mm. gracilis, more rarely perforating them. Sternoepicoracoideus present (*Cyclorana*, *Limnodynastes*). First and second vertebrae fused in genera where the notochord is persistent, free where the notochord is lost.

KEY TO GENERA.

I. Maxillary teeth present.

- A. Pupil vertical ; no fronto-parietal foramen ; 8 presacral vertebrae ; sacral diapophyses not dilated. Toes webbed, the membrane penetrating between the outer metatarsals *Mixophyes*.
 B. Pupil horizontal ; digital webbing not penetrating between the outer metatarsals.
 (1) No fronto-parietal foramen in adults.
 (a) First finger opposed to the remainder, the second very short ; vomerine teeth between the choanae ; 8 presacral vertebrae *Cyclorana*.
 (b) First finger not opposable to the remainder ; vomerine teeth behind the level of the choanae.
 (i) Toes with small terminal discs ; no dentary pseudo-teeth ; 8 presacral vertebrae *Lechriodus*.
 (ii) Toes without terminal discs ; male with 2 large, fang-like, dentary pseudo-teeth ; first and second vertebrae fused *Adelotus*.

- (2) A large fronto-parietal foramen ; 1st and 2nd vertebrae fused
 (a) Vomerine teeth between the choanae *Heleioporus*.
 (b) Vomerine teeth behind the level of the choanae
 (i) Vomerine series moderately extensive, extending laterally
 beyond the inner borders of the choanae . . . *Limnodynastes*.
 (ii) Vomerine series short and oblique, not extending laterally
 beyond the inner borders of the choanae *Philoria*.

II. Maxillary teeth absent ; a large fronto-parietal foramen ; 1st and 2nd
 vertebrae fused ; vomerine teeth small *Notaden*.

MIXOPHYES Günther.

Mixophyes Günther, 1864, *Proc. zool. Soc. Lond.* : 46 (Type species—*Mixophyes fasciolatus*);
idem, 1864, *Ann. Mag. nat. Hist.*, (3), **14** : 311; Cope, 1866, *J. Acad. nat. Sci. Philad.*, (2),
6 : 89, 93; Steindachner, 1867, *Reise Novara, Zool., Amph.* : 10; Keferstein, 1868, *Arch.*
Naturgesch., **34** : 254; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 188; Cope, 1889,
Bull. U.S. nat. Mus., **34** : 311; Nieden, 1923, *Das Tierreich, Anura I* : 518; Noble,
 1931, *Biol. Amph.* : 497.

Myxophyes Cope, 1865, *Nat. Hist. Rev.*, n.s., **5** : 111.
Hyla de Vis, 1884, *Proc. roy. Soc. Queensland*, **1** : 128.

Maxillary teeth present. Prevomer entire, bounding the choana anteriorly
 and laterally with an anterior projection towards the maxilla and a mesially-
 directed, dentigerous branch which does not reach the palatine ; fronto-parietals
 large, forming a median suture. Ear fully developed. Vertebrae procoelous ;
 8 presacals ; sacral diapophyses cylindrical ; coccyx articulating by two condyles.



TEXT-FIG. 4.—Anterior cranial elements of *Mixophyes fasciolatus* juv. $\times 5$. (From beneath.)

Omosternum cartilaginous ; sternum cartilaginous, entire posteriorly. Terminal
 phalanges simple.

Distal tendon of the m. semitendinosus passing ventral to the tendon of the
 m. gracilis. The hyolaryngeal apparatus has only been examined in a juvenile
 specimen and Trewavas (1933 : 512) considers such material unsuitable for
 comparison ; nevertheless it is apparent that the apparatus is *Heleioporus*-
 rather than *Crinia*-like, with a complete cricoid, m. omohyoideus present, and
 the mm. sternohyoideus and petrohyoidei attached at, or close to, the lateral
 edges of the hyoid plate.

Pupil vertical. Tongue subcircular, entire or emarginate, and scarcely free
 behind. Toes webbed, the membrane penetrating between the outer metatarsals.

Mixophyes fasciolatus fasciolatus Günther.

Mixophyes fasciolatus Günther, 1864, *Proc. zool. Soc. Lond.* : 46, pl. 7, fig. 1 (Type locality :
 —Clarence River, N.S.W.); *idem*, 1864, *Ann. Mag. nat. Hist.*, (3), **14** : 312; Krefft, 1867,
Cat. Industr. Prod. N.S.W., *Add.* : 107; Steindachner, 1867, *Reise Novara, Zool., Amph.* :

10; Günther, 1868, *Proc. zool. Soc. Lond.* : 479; Keferstein, 1868, *Arch. Naturgesch.*, **34** : 255, pl. 5, fig. 6; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 188; *idem*, 1885, *Ann. Mag. nat. Hist.*, (5), **16** : 387; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 372; *idem*, 1890, *op. cit.*, (2), **5** : 669-671; *idem*, 1892, *op. cit.*, (2), **7** : 18; *idem*, 1894, *op. cit.*, (2), **8** : 529; Lucas and le Souef, 1909, *Anim. Austral.* : 267, fig. ; Harrison, 1922, *Aust. Zool.*, **3**, 1 : 34; Nieden, 1923, *Das Tierreich, Anura* 1 : 518, fig. 350; Trewavas, 1933, *Phil. Trans. roy Soc. London*, **222**, B : 438, fig. 28.
Myxophyes fasciolatus Krefft, 1865, *Pap. Proc. roy Soc. Tasmania* : 16.
Mixophyes fasciolatus fasciolatus Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 10.
Hyla fenestrata de Vis, 1884, *Proc. roy. Soc. Queensland*, **1** : 128 (Type locality:—Tweed River).

Head broader than long. Snout rounded, not prominent, 1.4 to 1.5 times as long as the eye with obtusely angular canthus rostralis and oblique, slightly concave loreal region; nostril equidistant from the eye and the end of the snout; interorbital space equal to, or a little broader than, the width of an upper eyelid; tympanum very distinct, vertically oval, its horizontal diameter $\frac{1}{2}$ to $\frac{2}{3}$ that of the eye. Fingers slender, the first a trifle longer than the second, which is shorter than the fourth; subarticular tubercles well developed on the metacarpophalangeal joints only, with a smaller supernumerary tubercle proximal to each; two metacarpal tubercles. Toes two-thirds webbed, the edge of the membrane midway between the third and fourth toes being level with the distal subarticular tubercle of the third; three phalanges of the fourth toe free from web; subarticular tubercles moderate; an elongate, oval inner, but no outer, metatarsal tubercle. Tibio-tarsal articulation reaching the nostril or beyond the tip of the snout.

Skin smooth above and beneath; a curved supratympanic fold; anal region feebly granular.

Brown or olive above, the dorsum usually with scattered, irregular polygonal darker markings; a curved dark line from the tip of the snout, through the nostril, along the canthus rostralis and along the supratympanic fold, often spreading over the tympanum; a dark interorbital bar which may be prolonged backwards as a triangular or T-shaped marking. Flanks dark-spotted. Limbs with numerous narrow dark cross-bars which are most defined on the concealed surfaces; hinder side of the thighs dark-mottled. Lower surfaces white, the gular region of the male dotted and stippled close to the lower jaw.

Length from snout to vent : ♂ 63 mm.; ♀ 97 mm.

Male with a diffuse nuptial pad on the dorso-lateral surface of the first finger and edge of the inner metacarpal tubercle; a vocal sac. Embrace axillary; spawning apparently in spring or autumn in New South Wales (embrace in April, Harrison; tadpoles in advanced stage of development December, Fletcher).

The species is diurnal, frequenting the banks of creeks in deep, shady gullies and taking readily to the water when alarmed.

DISTRIBUTION : New South Wales east of the dividing range and southern Queensland.

SPECIMENS EXAMINED.

B.M. 62.10.26.3	♂	Clarence River	Krefft. COTYPE.
64.1.17.39	♀	" "	" "
88.7.3.1-2	♀, juv.	Mt. Wilson	Fletcher. "
88.7.3.3	♂	Springwood, N.S.W.	" "
1931.10.19.1	juv. (cleared)	Upper Maring River, N.S.W.	Hill. "

Mixophyes fasciolatus schevilli Loveridge.

Mixophyes fasciolatus Andersson, 1916, *K. Svenska Vetensk. Akad. Handl.*, **52**, 9: 7.
Mixophyes fasciolatus schevilli Loveridge, 1933, *Occ. Pap. Boston Soc. nat. Hist.*, **8**: 55.
 (Type localities:—Millaa Millaa and Lake Barrine, Atherton Tableland, and 4000 ft. Bellenden Ker Range, Queensland); *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 11.

Similar in general characters to the typical form, but with the toes $\frac{3}{4}$ webbed, (only two phalanges of the fourth and none of the fifth being free) and with the bars on the limbs tending to coalesce to form fewer, broader, bands.

Length from snout to vent: ♂ 61 mm.; ♀ 83 mm.

DISTRIBUTION: Atherton Tableland, Bellenden Ker Range, and Malanda, Queensland. Intermediates showing intergradation with the typical form are said to occur in the area from the Richmond River, N.S.W., to the Bunya Mountains of southern Queensland.

CYCLORANA¹ Steindachner.

Alytes Gray, 1842, *Zool. Misc.*, **2**: 56.
Chiroleptes (non Kirby, 1831) Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 34 (Type species:—*Alytes australis* Gray); Cope, 1865, *Nat. Hist. Rev.*, n.s., **5**: 108; *idem*, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6**: 89, 93; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 267; Cope, 1889, *Bull. U.S. nat. Mus.*, **34**: 312; Noble, 1931, *Biol. Amph.*: 497.
Chiroleptes (emend.) Spencer, 1901, *Proc. roy. Soc. Victoria*, (2), **13**: 176.
Cyclorana Steindachner, 1867, *Reise Novara, Zool., Amph.*: 29. (Type species:—*Cyclorana novae-hollandiae*).
Phractops Peters, 1867, *Mber. Akad. Berlin*: 30 (Type species:—*Phractops alutaceus*); Ogilby, 1907, *Proc. roy. Soc. Queensland*, **20**: 32; Nieden, 1923, *Das Tierreich, Anura I*: 520; Waite, 1929, *Rep. Amph. S. Austral.*: 245.
Mitrolysis Cope, 1889, *Bull. U.S. nat. Mus.*, **34**: 312 (Type species:—*Chiroleptes alboguttatus* Günther); Nieden, 1923, *Das Tierreich, Anura I*: 524; Noble, 1931, *Biol. Amph.*: 947.

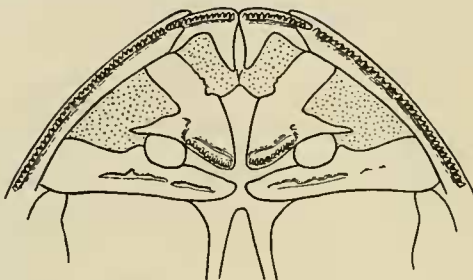
Maxillary teeth present. Prevomer large, bounding the choanae anteriorly, with an anterior process which may meet the premaxilla, and a short, posterior, dentigerous portion between the choanae, not overlying the palatine. Fronto-parietals forming a median suture, their lateral borders raised to form a distinct ridge. Ear fully developed. In adult individuals the dorsal surfaces of the skull are often somewhat rugose and in *P. australis* a considerable amount of secondary rugose bone is present on the nasals, premaxillae, maxillae, fronto-parietals and squamosals, the zygomatic process being greatly enlarged and forming a broad arcade across to the maxilla. Palatines with more or less distinctly raised ridges and prominences ventrally. Vertebrae procoelous, the condyle completely ankylosed and the notochord not persistent; sacral diapophyses slightly dilated; urostyle articulating by two condyles; 8 presacral vertebrae. Omosternum well developed; sternum large, cartilaginous, bifid posteriorly; clavicles strongly curved. Terminal phalanges simple.

¹ As Ogilby (1907, *loc. cit.*) has pointed out, the name *Chiroleptes*, so frequently used for this genus, is a homonym and must be dropped. But his selection of *Phractops* to replace it cannot be maintained. This name was proposed by Peters at a sitting of the Prussian Academy of Science on January 10, 1867, and was not published until later in that year; the January Heft of the *Monatsbericht* was actually not received at the library of Göttingen University until May. But Steindachner's account of the Amphibia of the Novara collection, in which appears the name *Cyclorana*, was actually published and laid on the table of the Vienna Academy on the same day that Peters read his paper (January 10) (cf. *Anz. Akad. wiss. Wien*, **4**: 11).

Distal tendon of the m. semitendinosus passing ventral to the mm. graciles. Alary processes of the hyoid expanded distally, but arising as narrow stalks proximally, similar to those of *Heleioporus*.

Pupil horizontal but with a downwardly-directed ventral angle. Tongue subcircular, partly free behind. Toes more or less webbed. Second finger short, the first opposable to the remainder.

The species of this genus fall into two clearly-marked groups as regards their general habitus. First there are slender species with thin digital webbing of the type usually associated with "grass-frogs" or aquatic species. Of these *inermis* shows very little trace of the opposable inner digit and has two metatarsal tubercles; *dahliei* has the digital characteristic of the genus well developed and has lost the outer metatarsal tubercle whilst *alboguttatus* has the inner metatarsal



TEXT-FIG. 5.—Anterior cranial elements of *Cyclorana australis*. $\times 2$. (From beneath.)

tubercle strongly compressed and so approaches the second group of species, which are all of more or less globose habitus, and are typical fossorial species with a shovel-shaped metatarsal tubercle and webbing, when present, of a thick fleshy nature.

SYNOPSIS OF THE SPECIES.

- I. Inner metatarsal tubercle not shovel-shaped; habitus slender.
 - A. Toes $\frac{3}{4}$ webbed; two metatarsal tubercles *C. inermis*.
 - B. Toes fully webbed; a single metatarsal tubercle *C. dahliei*.
- II. Inner metatarsal tubercle shovel-shaped.
 - A. A straight dorso-lateral fold on each side of the back
 - (1) Zygomatic process of the squamosal heavily sculptured and forming a broad suture with the maxilla. Habitus stout *C. australis*.
 - (2) Zygomatic process not sculptured and separated from the maxilla or only very narrowly in contact with it. Habitus slender *C. alboguttatus*.
 - B. No definite dorso-lateral fold.
 - (1) Toes less than half webbed.
 - (a) Web midway between the 3rd and 4th toes not extending beyond the proximal subarticular tubercle of the fourth toe; metatarsal tubercle shorter than its distance from the tip of the inner toe; a strongly marked colour-pattern *C. brevipes*.

- (b) Web midway between the 3rd and 4th toes reaching nearly to the level of the distal subarticular tubercle of the third ; metatarsal tubercle as long as, or longer than its distance from the tip of the inner toe ; colour pattern indistinct

C. cultripes.

- (2) Toes $\frac{3}{4}$ webbed, or more *C. platycephalus*.

Cyclorana inermis (Peters).

Chiroleptes inermis Peters, 1867, *Mber. Akad. Berlin* : 30 (Type locality:—Rockhampton) ; Keferstein, 1868, *Arch. Naturgesch.*, **34** : 267 ; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 271 ; Andersson, 1913, *K. Svenska Vetensk. Akad. Handl.*, **52**, 4 : 16 ; *idem*, 1916, *K. Svenska Vetensk. Akad. Handl.*, **52**, 9 : 12.

Phractops inermis Nieden, 1923, *Das Tierreich, Anura I* : 524.

Habitus slender ; head as long as broad. Snout pointed, slightly prominent, 1.5 to 1.6 times as long as the eye, with rounded canthus rostralis and slightly oblique, feebly concave loreal region ; nostril midway between the eye and the end of the snout ; interorbital space as broad as, or a little narrower than the upper eyelid ; tympanum very distinct, $\frac{2}{3}$ to $\frac{3}{4}$ the diameter of the eye. Fingers moderately long, free, the first distinctly longer than the second, but the latter is better developed than in the other members of the genus, and the opposition of the first digit to the remainder is not well marked ; subarticular tubercles very prominent ; two large metacarpal tubercles and rows of smaller tubercles on the palm. Toes $\frac{3}{4}$ webbed, the membrane midway between the third and fourth extending beyond the distal tubercle of the third but not to the middle tubercle of the fourth ; subarticular tubercles prominent ; a prominent oval inner, and a smaller rounded outer, metatarsal tubercle ; a dermal fold or slight fringe along the inner side of the inner digit and tarsus. Tibio-tarsal articulation reaching the centre of the eye or between this point and a little beyond the tip of the snout.

Skin with scattered warts above ; belly and hinder side of thighs finely granular ; throat and chest smooth.

Greyish brown above with scattered, indistinct darker mottlings ; edge of the upper lip with white flecks ; hinder side of the thighs spotted or marbled with dark brown and white ; tibiae cross-barred ; lower surfaces immaculate white except the throat of the male, which is marbled with brown.

Male with a vocal sac and a diffuse nuptial pad on the inner side of the first finger.

Length from snout to vent : ♂ 35 mm.

DISTRIBUTION : Queensland (Rockhampton, Kimberley, Torrens Creek).

SPECIMENS EXAMINED.

B.M. 1924.3.3.3	juv.	Torrens Creek, 1600 ft.	Coll. : G. H. Wilkins.
Mus. Leiden, 1888	♂	Rockhampton	Mus. Godeffroy. (PARATYPE).

Cyclorana dahliei (Boulenger).

Chiroleptes dahliei Boulenger, 1896, *Proc. zool. Soc. Lond.* : 867, pl. 49, fig. 2 (Type locality:—Daly River, N. Australia) ; Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, **22** : 682, 684.

Phractops dahliei Nieden, 1923, *Das Tierreich, Anura I* : 522 ; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 11.

Habitus slender; head as long as broad. Snout rounded, not prominent, 1.5 times as long as the eye,¹ with rounded canthus rostralis and very oblique, slightly concave loreal region; nostril equidistant from the eye and the end of the snout; interorbital space narrower than the upper eyelid; tympanum very distinct, its horizontal diameter $\frac{3}{4}$ that of the eye. Fingers moderate, the first much longer than the second and opposed to the remainder; subarticular tubercles moderately distinct, but the two metacarpals not well defined. Toes fully webbed, the membrane extending to some extent between the metatarsals; subarticular tubercles not well marked; an oval inner, but no outer, metatarsal tubercle; a slight fold along the inner edge of the metatarsus. Tibio-tarsal articulation reaching the loreal region.

Skin feebly shagreened above; a distinct curved supratympanic fold and a median nuchal furrow; lower surfaces smooth, except the hinder side of the thighs, which are feebly granular.

Brownish-olive above, with a very faint, lighter, dorsal streak; a dark canthal stripe; flanks and hinder side of the thighs spotted and marbled with white. Lower surfaces immaculate white, except the sides of the throat and the limbs, which are dotted with dark brown.

Male with a vocal sac.

Length from snout to vent: ♂ 70 mm.; ♀ 67 mm.

DISTRIBUTION: Northern Territory.

SPECIMEN EXAMINED.

B.M. 95.11.14.24

♀

Daly River, N.T.

Dahl. COTYPE.

Cyclorana australis (Gray).

- Alytes australis* Gray, 1842, *Zool. Misc.*, 2: 56 (Type locality:—North coast of Australia).
Chiroleptes australis Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 34; Krefft, 1865, *Pap. Proc. roy. Soc. Tasmania*: 17; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.*: 107; Günther, 1867, *Ann. Mag. nat. Hist.*, (3), 20: 54; *idem*, 1868, *Zool. Rec.*, 4 (1867): 145; Keferstein, 1868, *Arch. Naturgesch.*, 34: 267; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 269; Boettger, 1894, *Denkschr. med.-naturw. Ges. Jena*, 8: 109; Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, 22: 678; Andersson, 1913, *K. Svenska Vetensk. Akad. Handl.*, 52, 4: 15; Harrison, 1922, *Aust. Zool.*, 3, 1: 34.
Phractops australis Fry, 1914, *Rec. W. Aust. Mus.*, 1: 204; Nieden, 1923, *Das Tierreich, Anura I*: 523, fig. 355; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 13.
Cyclorana novaehollandiae Steindachner, 1867, *Reise Novara, Zool., Amph.*: 29, pl. 2, figs. 7–10 (Type locality:—Rockhampton); Keferstein, 1868, *Arch. Naturgesch.*, 34: 267.
Phractops alutaceus Peters, 1867, *Mber. Akad. Berlin*: 31 (Type locality:—Rockhampton).
Mitrolysis alboguttatus (part) Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 13.

Upper surfaces of the premaxillae, maxillae, fronto-parietals and squamosals strongly sculptured, the zygomatic process of the latter forming a broad suture with the maxilla. Habitus stout; head depressed, as broad as long in juveniles, but increasing in breadth with age so that in adults it is very much broader than long, more so in females than in males. Snout depressed, not prominent, 1.75 (adults) to twice (juveniles) as long as the eye, with rounded canthus rostralis and very oblique, concave loreal region; nostril equidistant from the eye and the end of the snout or, more usually, a little nearer the latter; interorbital space equal to, or a little narrower than, the upper eyelid; tympanum distinct, slightly more than half, rarely $\frac{2}{3}$, the diameter of the eye. Fingers moderate;

¹ Loveridge's (1935: 13) contention that Boulenger measured the snout from the nostril appears to be without foundation, and his assertion that the first finger may, in this species, be shorter than the second may indicate a traumatic condition or confusion of species.

the first much longer than the second and opposed to the remainder; subarticular tubercles prominent; palm with small circular tubercles; two metacarpal tubercles. Toes $\frac{1}{3}$ webbed, the edge of the membrane midway between the third and fourth normally reaching halfway between the distal subarticular tubercle of the third toe and the proximal tubercle of the fourth; rarely it may reach almost to the former of these points or only just beyond the latter; subarticular tubercles distinct; a very large, shovel-shaped inner metatarsal tubercle, but no outer; a slight fold along the inner edge of the tarsus. Tibio-tarsal articulation reaching the eye, or, in larger specimens, the tympanic region.

Skin regularly shagreened above, often with larger scattered warts; a distinct median occipito-nuchal groove; a strong, curved, supratympanic fold from which a short, straight lateral fold may branch; a distinct dorso-lateral fold on each side of the back; sometimes a distinct gland between the angle of the mouth and the insertion of the fore-limb. Belly and hinder side of the thighs finely granular; throat almost smooth in females, but distinctly granular in males.

Brown or grey above with some darker markings, of which the most constant are a cantho-temporal streak, a vertical bar beneath the eye and darker smudges along the sides of the dorso-lateral folds which are themselves white in juveniles. Flanks and hindside of the thighs dusky with lighter mottlings (not circular spots as in *alboguttatus*). Lower surfaces white, the chin and throat blotched with brown in females and juveniles, uniformly infusate in breeding males.

Male with a vocal sac, and, at the breeding season, diffuse nuptial asperities on the dorso-lateral surface of the inner finger and a small, but distinct, button-like prominence where the columella auris abuts against the tympanum. Breeding in West Australia appears to take place about midsummer.

Length from snout to vent: ♂ 87 mm.¹; ♀ 97 mm.

Juveniles at metamorphosis, 27 mm.

DISTRIBUTION: Northern West Australia, Northern Territory and Queensland.

SPECIMENS EXAMINED.

B.M.	67.2.19.56	♂	Nicol Bay, W.A.	du Bonlay.
	96.7.2.17-18	♂♀	Roebuck Bay, W.A.	Dahl.
	84.9.13.26	♀	Port Darwin.	Buckland.
	42.2.24.14-15	♀, juv.	Port Essington, N.T.	Gilbert. COTYPES.
	1908.2.25.29-30	♂♀	Alexandria Sta., N.T.	Stalker.
	70.11.30.72	♀	Queensland.	Thomson.
	67.5.6.86	♂	Rockhampton.	Dämel.
	67.5.6.96	juv.	"	"
	67.5.6.95	♂	"	"
	1924.10.25.4	juv.	Westwood, nr. Rockhampton.	Wilkins.
	1903.10.19.36-37	♂♀	Cooktown, Q.	Bellenden Ker.
	64.10.27.58	♀	Port Denison, Q.	Kreft.
	67.5.6.80	juv.	Port Denison.	Dämel.
	67.5.6.81	juv.	" "Australia."	Kreft.
	64.7.22.5	♀ skel.	Alexandria Sta., N.T.	Stalker.
	1906.11.2.6	♀ skel.	Rockhampton, Q.	(Godeffroy Mus.) (Co-type of <i>Phractops alutaceus</i> Peters.)
Mus. Leiden	3867	♀		(Godeffroy Mus.)
" "	4237	♂	Queensland.	Söderberg.
Swedish Mus.	1562	juv.	Mowla Down, Kimberley Div., W.A.	

¹ The "male" 27 mm. long reported by Andersson (1913) proves on re-examination to be a juvenile just through metamorphosis, with an incompletely resorbed tail.

Cyclorana alboguttatus (Günther).

- Chiropletes alboguttatus* Günther, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 54 (Type locality :— Port Denison, Cape York); *idem*, 1868, *Proc. zool. Soc. Lond.* : 480; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 270, pl. 18, fig. 1; Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, **22**, 1897 : 678.
- Chiropletes albopunctatus* (? lapsus calami) Fletcher, 1894, *Proc. Linn. Soc. N.S.W.*, 1893, (2), **8** : 525, footnote.
- Mitrolysis alboguttatus* Cope, 1889, *Bull. U.S. nat. Mus.*, **34** : 312; Nieden, 1923, *Das Tierreich, Anura I* : 524, fig. 356; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 13 (part).

Habitus slender; head as long as broad or only slightly broader than long. Snout conical, slightly prominent, 1.8 to 2.0 times as long as the eye, with rounded canthus rostralis and very oblique loreal region; nostril equidistant from the eye and the end of the snout; interorbital space as broad as, or a little narrower than the upper eyelid; tympanum distinct $\frac{2}{3}$ to $\frac{3}{4}$ the horizontal diameter of the eye. Fingers slightly depressed, with lateral "seams," the first much longer than the second and opposed to the remainder; subarticular tubercles prominent; palm with small circular tubercles and two moderately well-developed metacarpal tubercles. Toes nearly half webbed, the edge of the membrane midway between the 3rd and 4th toes, reaching nearly to the level of the distal tubercle of the 3rd; subarticular tubercles moderately prominent; a moderately large compressed inner, but no outer, metatarsal tubercle; a slight tarsal fold. Tibio-tarsal articulation reaching the eye or the nostril.

Skin with some scattered warts above; a curved supratympanic fold and a distinct straight dorso-lateral fold on each side of the back; a more or less distinct median occipito-nuchal furrow. Belly and hinder side of the thighs finely granular; throat and chest smooth.

Olive or brown above, with some obscure black mottlings; a dark canthal streak; flanks and hinder side of the thighs with numerous, closely set, circular white spots; edge of the upper lip brown, dotted with white. Lower surfaces white, the throat and chest usually marbled and freckled with brown.

Male with a vocal sac opening by a slit on each side of the tongue and a diffuse nuptial pad on the dorso-lateral aspect of the first finger and inner metacarpal tubercle.

Length from snout to vent : ♂ 59 mm. ; ♀ 65 mm.

DISTRIBUTION : Northern Territory?, Queensland, and Northern New South Wales. Loveridge (1935) has recorded this species from Alexandria, N.T., but another specimen from the same locality obtained at the same time by the same collector is preserved as a skeleton in the British Museum; it has the zygomatic process of the squamosal heavily sculptured and forming a broad suture with the maxilla as in *P. australis*, whereas in *P. alboguttatus* the two fail to meet, or only just make contact at a narrow point, and the squamosal is not sculptured.

SPECIMENS EXAMINED.

B.M. RR. 1936.12.	2 ♀♀	Port Denison.	Dämel. COTYPES.
3.125-126			
64.10.27.40	♂	"	Kreffit.
67.5.6.78-79	♂♀	Cape York.	Dämel. COTYPES.
64.1.17.40	♂	? Clarence River, N.S.W.	Kreffit.
Mus. Leiden 4263	♀	Queensland.	(Godeffroy Mus.)

Cyclorana brevipes (Peters).

Chiroleptes brevipes Peters, 1871, *Mber. Akad. Berlin* : 648 (Type locality :—Fort Bowen, Queensland); Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 269.

Phractops brevipes Nieden, 1923, *Das Tierreich, Anura* I : 523.

Chiroleptes brevipalmatus Günther, 1876, *J. Mus. Godeffroy*, 12 : 47 (Type localities :—Port Denison, Gayndah and Peak Downs, Queensland); Boulenger, 1882, *op.cit.* : 269, pl. 17, fig. 5.

Phractops brevipalmatus Fry, 1915, *Proc. roy. Soc. Queensland*, 27 : 70 (part); Nieden, 1923, *Das Tierreich, Anura* I : 522.

Habitus moderate; head a little broader than long. Snout rounded, scarcely prominent, 1.25 to 1.5 times as long as the eye, with obtusely angular canthus rostralis and oblique, scarcely concave, loreal region; nostril midway between the eye and the end of the snout; interorbital space narrower than the upper eyelid; tympanum distinct, its horizontal diameter half, or very slightly more than half, that of the eye. Fingers moderate, the first much longer than the second, and opposed to the remainder; subarticular tubercles well developed; palm tubercular; two distinct metacarpal tubercles. Toes less than $\frac{1}{4}$ webbed, the membrane midway between the third and fourth not extending beyond the proximal subarticular tubercle of the latter; subarticular tubercles prominent; a large shovel-shaped metatarsal tubercle which is, however, distinctly shorter than its distance from the tip of the inner toe. Tibio-tarsal articulation reaching the tympanum or the posterior corner of the eye.

Back somewhat warty; a distinct curved supratympanic fold; belly and lower surfaces of the thighs finely granular; throat smooth in females, granular in males.

Pale olive or brown above with dark brown markings arranged as follows: a curved cantho-temporal streak; edge of upper lip spotted; a large, subtriangular interorbital blotch, the apex directed forwards; back with sharply defined vermiculations, which may have a general longitudinal arrangement. Usually a fine white mid-dorsal line. Upper surfaces of the limbs olive-brown, spotted irregularly with lighter; hinder side of the thighs dark brown, uniform or with a few white flecks. Lower surfaces dirty white or pale brown; the gular region of the female with or without brown spots, that of the male infusate.

Male with a vocal sac and diffuse nuptial asperities on the dorso-lateral surface of the first finger and metacarpal tubercle.

Length from snout to vent : ♂ 37 mm.; ♀ 42 mm.

DISTRIBUTION : Eastern Queensland.

It seems probable that Loveridge (1935 : 12) is correct in regarding *brevipalmatus* as a synonym of *brevipes*, but it also seems highly probable that records of both species from West Australia, South Australia, and the west of Queensland and New South Wales refer to a species distinct from either (*C. cultripes*), differing in its stouter habitus, shorter digits, more extensive webbing, larger metatarsal tubercle, more coarsely granular skin and obscure colour-pattern.

SPECIMENS EXAMINED.

B.M. 64.10.27.41	♂	Port Denison.	Dämel	Cotypes of <i>C. brevipalmatus</i> Günther.
67.3.4.37	♀	Peak Downs.	"	
76.3.4.55	♀	Gayndah.	"	
1926.2.25.1	♀	Coorooman, nr. Rockhampton.	Wilkins.	

Cyclorana cultripes sp. n.

Chiroleptes brevipalmatus (non Günther) Spencer, 1896, *Rep. Horn. Exped. C. Austral.*, (2), (Zoology) : 165; Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, 22 : 678-682; Lucas & le Souef, 1909, *Anim. Australia* : 277.
Phractops brevipalmatus Fry, 1914, *Rec. W. Aust. Mus.*, 1 : 200; *idem*, 1915, *Proc. roy. Soc. Queensland*, 27 : 70 (part); Waite, 1929, *Rep. Amph. S. Australia* : 248.
Phractops brevipes (non Peters) Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 12.

Habitus moderately stout; head a little broader than long. Snout rounded, scarcely prominent, 1.4 to 1.5 times as long as the eye, with obtusely angular canthus rostralis and oblique, slightly concave loreal region; nostril very slightly nearer the tip of the snout than the eye; interorbital space a little narrower than the upper eyelid; tympanum $\frac{1}{2}$ to $\frac{3}{4}$ the diameter of the eye. Fingers rather short, somewhat depressed, the first longer than the second and opposed to the remainder; subarticular tubercles prominent; palm slightly tubercular; two large flat metacarpal tubercles. Toes $\frac{1}{2}$ webbed, the edge of the membrane midway between the third and fourth reaching nearly to the level of the distal subarticular tubercle of the third; subarticular tubercles moderate; a very large, shovel-shaped inner metatarsal tubercle, as long as, or longer than, its distance from the tip of the inner toe; no outer. Tibio-tarsal articulation reaching the tympanum.

Skin distinctly warty above; a slight occipito-nuchal furrow; a strong, curved, supratympanic fold. Belly and lower surfaces of the thighs coarsely granular; chin slightly granular in males, smooth in females.

Dull yellow- or grey-brown above with some indistinct darker markings in the form of a cantho-temporal streak, some labial spotting, a dark blotch on the top of the head from the level of the posterior corner of the eyes forwards, and a transverse bar just behind the occiput; the area between the latter and the head-marking lighter. Remainder of the back with very indistinct darker spots and a fine white vertebral line. Groins and hinder side of the thighs brown, mottled with lighter. Lower surfaces white, the chin dappled with brown in females and infusate in males.

Male with a vocal sac and 2 diffuse nuptial pads, one on the dorso-lateral surface of the inner finger and the other on the inner metacarpal tubercle. Inner 2 fingers of breeding females slightly spatulate.

Length from snout to vent : ♂ 46 mm. ; ♀ 50 mm.

DISTRIBUTION : Western New South Wales, Northern Territory and northern West Australia; probably northern South Australia also.

This form has hitherto been confused with *P. brevipes* (q.v.); the two are closely allied and may ultimately prove to be only racially distinct.

SPECIMENS EXAMINED.

B.M. 1908.2.25.33	♂	Alexandria, N.T.	Stalker.	HOLOTYPE.
1908.2.25.31-32	♂♀	Wilcannia, Darling	Helms.	} PARATYPES.
1911.3.28.1	♀	River, N.S.W.		

Cyclorana platycephalus (Günther).

Chiroleptes platycephalus Günther, 1873, *Ann. Mag. nat. Hist.*, (4), 11 : 350 (Type locality :— Fort Bourke); Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 268, pl. 17, fig. 4; Fletcher, 1890, *Proc. Linn. Soc. N.S.W.*, (2), 5 : 673, 675; *idem*, 1891, *op. cit.*, (2), 6 : 265, 269, 271; *idem*, 1892, *op. cit.*, (2), 7 : 12; Spencer, 1896, *Rep. Horn. Exped. C. Austral.*, 2, (Zool.) : 160, pl. 13, fig. 1, pl. 14, figs. 5-9; Lucas & le Souef, 1909, *Anim. Austral.* : 278, fig. 1; Harrison, 1922, *Aust. Zool.*, 3, 1 : 34.

Cheiroleptes platycephalus Spencer & Gillen, 1912, *Across Australia*, 1 : 59, pl. i, fig. a.
Phractops platycephalus; Nieden, 1923, *Das Tierreich, Anura* 1 : 520, figs. 352-354; Waite, 1929, *Rep. Amph. S. Austral.* : 246, fig. 176; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 12.

Habitus stout. Head broader than long, proportionately broader in older individuals, and generally broader in eastern than in western specimens. Snout rounded in eastern districts, more acuminate and prominent in the west, 1.6 to 2.0 times as long as the eye, with indistinct canthus rostralis and very oblique, rounded loreal region; nostril equidistant from the eye and the end of the snout or a little nearer the former; interorbital space as broad as, or a little broader than, the upper eyelid; tympanum distinct $\frac{2}{3}$ to $\frac{3}{4}$ the diameter of the eye and varying in its proximity to the latter. Fingers moderate, depressed, the first much longer than the second and opposed to the remainder; subarticular tubercles small but prominent; two metacarpal tubercles, the outer sometimes rather indistinct. Toes fully webbed, the membrane rather fleshy; subarticular tubercles small; a large, shovel-shaped metatarsal tubercle much longer than its distance from the tip of the inner toe; a slight fold along the inner edge of the tarsus. Tibio-tarsal articulation reaching the shoulder or the tympanum.¹

Skin smooth or, more usually, with scattered warts, the condition varying with the degree of distension on account of stored fluids in the body; a curved supra-tympanic fold; lower surfaces granular.

In spirit, or when alive during the dry season the colour is olive-grey, grey-brown or yellowish, freckled with indistinct darker spots and blotches not arranged after any definite pattern; lower surfaces dirty white, the throat of the male dotted with brown or blue-black. After leaving their burrows at the onset of rain the colour of juveniles and half-grown individuals changes to yellow with bright green markings, older specimens being duller, with more diffuse green patches. The iris is golden with dark flecks, tympanum yellowish-brown, the sides of the body and limbs orange brown and the digital webbing often distinctly pink.

Length from snout to vent : ♂ 56 mm. ; ♀ 68 mm.

Male with a vocal sac and a diffuse nuptial pad on the metacarpo-phalangeal knuckle of the first finger and extending on to the inner metacarpal tubercle.

DISTRIBUTION : Arid districts of the interior of Australia from Murchison in the west to the western districts of New South Wales, including the southern parts of the Northern Territory and northern South Australia.

This species is essentially cryptozoic, frequenting arid regions and aestivating through the dry season in burrows about a foot deep on the banks of creeks and near water-holes; impervious clay soils appear to be preferred, and during the period of aestivation the frog is greatly distended with water stored in the urinary bladder, the lymph spaces and body cavity. Breeding takes place on the advent of rain (January to February in Central Australia) and development is very rapid, possibly not more than two weeks elapsing from the laying of the eggs to metamorphosis. The tadpole reaches a length of 69 mm. and has the following characters: Body 1.5 times as long as wide and $\frac{2}{3}$ the length of the tail, ovoid, with eyes and nostrils directed upwards, the nostril nearer the tip of the snout than the centre of the eye; spiraculum sinistral; anus dextral, near the edge of the lower caudal crest; tail acutely pointed, three times as long as deep, the lower crest deeper than the upper, but not as deep as the muscular portion

¹ It is the tibio-tarsal articulation which reaches the tympanum in the type as originally described, and not the tarso-metatarsal as suggested by Loveridge (1935 : 12).

at its base. Mouth, except the median third anteriorly, surrounded by papillae which form a double row and invade the oral cone at the corners; horny mandibles strong and serrated; labial teeth in series $\frac{2}{3}$, the innermost both above and below divided, the outermost shortest. Body and muscular part of the tail dull yellow, with faint blotches of darker; caudal crests with dark mottling.

Length from snout to vent at metamorphosis: 31 mm.

SPECIMENS EXAMINED.

B.M. 1937.7.22.1-2	♂♀	Dalgaranger Sta., near Yalgoo, W.A.	Nicholls.
1908.5.28.62-64	♂, 2 ♀♀	Central Australia.	(Gerrard.)
97.1.20.29-30	Larvae.	"	Horn.
97.1.20.28	♀	Charlotte Waters.	"
1905.10.31.46	♀	100 miles east of Lake Eyre.	Hillier.
92.9.16.11	♀	Euroka, N.S.W.	Rose.
73.4.30.18	♀	Fort Bourke, N.S.W.	(Sydney Mus.) TYPE.

LECHRIODUS Boulenger.

Asterophrys (non Tschudi) Doria, 1875, *Ann. Mus. Stor. nat. Genova*, 6: 355; Peters & Doria, 1878, *Ann. Mus. Stor. nat. Genova*, 13: 417.

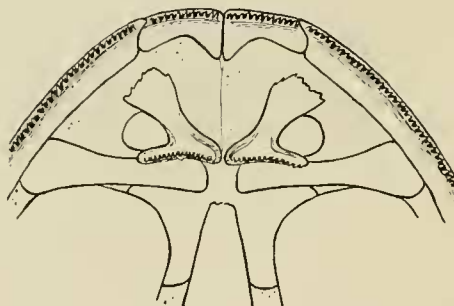
Batrachopsis (non Fitzinger) Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 439 (Type species:—*Asterophrys melanopyga* Doria); van Kampen, 1923, *Amph. Indo-Austr. Archip.*: 16.

Lechriodus Boulenger, 1882, *Cat. Batr. Grad. Brit. Mus.*: 116 (substitute name for *Batrachopsis* Boulenger); Noble, 1922, *Bull. Amer. Mus. nat. Hist.*, 46: 73; Nieden, 1923, *Das Tierreich, Anura* I: 49; Noble, 1924, *Amer. Mus. Novit.*, 132: 11; *idem*, 1931, *Biol. Amph.*: 497; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 22.

Phanerotis Boulenger, 1890, *Proc. Linn. Soc. N.S.W.*, (2), 5: 593 (Type species:—*Phanerotis fleischeri*).

Ranaster (part) Nieden, 1923, *Das Tierreich, Anura* I: 535.

Maxillary teeth present. Prevomer present, entire, its post-choanal portion large, overlying at least the mesial half of the palatine, dentigerous; fronto-parietals well developed, forming a median suture. Ear fully developed.





TEXT-FIG. 6. Anterior cranial elements of *Lechriodus platyceps*. $\times 2$. (From beneath.)

Vertebrae procoelous with very long transverse processes; 8 presacals; sacral diapophyses strongly dilated; coccyx articulating by two condyles. Omosternum cartilaginous; sternum bifid posteriorly, cartilaginous. Terminal phalanges simple.

Distal tendon of the m. semitendinosus perforating the gracilis complex. Alary processes of the hyoid expanded distally but with a narrow stalk proximally as in *Limnodynastes* and *Heleioporus*.

Pupil horizontal. Tongue subcircular, slightly free behind. Toes with a rudiment of web and very small terminal discs.

SYNOPSIS OF THE SPECIES.

- I. Head not broader than long ; first finger as long as or longer than the second ; small species of which the females have normal digits and the nuptial pad of the male is composed of minute spines.
 - A. Snout more than once and a half as long as the eye ; first finger longer than the second *L. melanopyga*.
 - B. Snout less than once and a half as long as the eye ; first finger equal to, or a little shorter than, the second
 - (1) A small -shaped fold on the scapular region *L. fletcheri*.
 - (2) A small -shaped fold on the interorbit and a pair of curved, convergent dorso-lateral folds or rows of plicae *L. papuanus*.
- II. Head much broader than long ; first finger shorter than the second ; large species, of which the females have the first and second fingers strongly fringed and males have nuptial pads composed of closely set, but relatively large spines *L. platyceps*.

Lechriodus melanopyga (Doria).

- Asterophrys melanopyga* Doria, 1875, *Ann. Mus. Stor. nat. Genova*, 6 (1874) : 355, pl. xii, fig. k (Type locality :—Wokan, Aru Islands).
Batrachopsis melanopyga (part) Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 439 ; van Kampen, 1923, *Amph. Indo-Austr. Archip.* : 17.
Lechriodus melanopyga (part) Nieden, 1923, *Das Tierreich, Anura I* : 49 ; Noble, 1924, *Amer. Mus. Novit.*, 132 : figs. 5, 7 (myology).

Vomerine teeth in long, curved series extending laterally a little beyond the choanae. Head longer than broad ; its width contained more than 2.5 times in the total length ; snout rounded, not prominent, 1.6 times as long as the eye ; canthus rostralis angular ; loreal region oblique, not concave ; nostril nearly twice as far distant from the eye as from the tip of the snout ; interorbital space narrower than the upper eyelid ; tympanum distinct, vertically oval, its vertical diameter $\frac{3}{4}$ the horizontal diameter of the eye. Fingers free, slender, the first a little longer than the second ; subarticular tubercles large and prominent ; a smaller supernumerary tubercle proximal to the base of each finger ; a prominent oval inner, and a rather indistinct outer, metacarpal tubercle. Toes slender, with a rudiment of web and small terminal dilatations ; subarticular tubercles prominent ; an elongate oval inner, but no outer, metatarsal tubercle. Tibio-tarsal articulation extending a little beyond the end of the snout.

Skin almost smooth above, though minute pustules are present more especially on the upper eyelid, about the ear and on the flanks. Two folds arise from the posterior corner of the upper eyelid, the one running above the tympanum to the flanks, and the other, somewhat indistinct and interrupted, composed of a row of pustules, curves towards its fellow on the middle of the back and then runs parallel with it on to the coccygeal region. Lower surfaces smooth. A very small papilla on the heel.

Brownish grey above, a light line connects the upper eyelids and may extend forwards to cover the whole of the upper surface of the snout; a dark bar runs obliquely forwards from beneath the eye to the edge of the upper lip and may be broadened anteriorly to cover the whole loreal region; a deep black marking may border the supratympanic fold inferiorly, its lower margin irregular and crossing the tympanum; other black spots may be present on the flanks, and sometimes there are large, indefinite lighter areas on the back. Hind limbs with alternating broader and narrower cross-bars above; concealed surfaces of the thighs and tibiae, as well as the lower surfaces of the forearms, tarsi and feet blackish. Lower surfaces uniform white.

Length from snout to vent: ♀ 50 mm.

DISTRIBUTION: Aru Islands.

Although the type of *melanopyga* was afterwards (Peters and Doria, 1878: 417) said to be a juvenile when larger specimens from New Guinea were obtained for comparison, the single specimen collected in the Aru Islands by the "Challenger" Expedition is of approximately the same size, and is a sexually mature female. It also differs from specimens from New Guinea in its much narrower head, longer first finger and smoother skin, so that there seems to be every probability that the *Lechriodus* of the Aru Islands is not conspecific with that from the northern and western parts of New Guinea which has hitherto been known as *melanopyga*, but which must now receive a new name. Records of a small "*melanopyga*" from S.E. New Guinea in all probability refer to *L. fletcheri* (q.v.).

SPECIMEN EXAMINED.

B.M. 82.7.14.31	♀	Aru Islands.	"Challenger" Exped.	TOPO- TYPE.
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Lechriodus fletcheri (Boul.).

Phanerotis fletcheri Boulenger, 1890, *Proc. Linn. Soc. N.S.W.*, (2), 5: 494 (Type locality:—Dunoon, Richmond River, N.S.W.); Fletcher, 1890, *Proc. Linn. Soc. N.S.W.*, (2) 5: 669–675; *idem*, 1894, *op. cit.*, (2), 8: 530; Lucas & le Souef, 1909, *Anim. Austral.*: 274; Andersson, 1913, *Jb. nassau. Ver. Naturk.*, 66: 75; Fry, 1915, *Proc. roy. Soc. Queensland*, 27: 69, fig. 1, pl. i, fig. 2; Andersson, 1916, *K. Svenska Vetensk. Akad. Handl.*, 52, 9: 10, pl. i, fig. 3; van Kampen, 1923, *Amph. Indo-Austr. Archip.*: 18.

Ranaster fletcheri Nieden, 1923, *Das Tierreich, Amura I*: 536.

Lechriodus fletcheri Noble, 1931, *Biol. Amph.*: 497; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 22.

? *Batrachopsis melanopyga* Boulenger, 1898, *Ann. Mus. Stor. nat. Genova*, 18: 17.

Vomerine teeth in slightly curved series which do not extend laterally beyond the choanae. Head as long as broad. Snout rounded, not prominent, 1.4 times as long as the eye, with angular canthus rostralis and oblique, slightly concave loreal region; nostril 1.3 times as far from the eye as from the tip of the snout; interorbital space as broad as the upper eyelid; tympanum distinct, vertically oval, its vertical diameter $\frac{3}{4}$ the length of the eye. Fingers moderate, the first equal to or a little shorter than the second; subarticular tubercles large and prominent; a slight, fleshy, tubercle-like webbing between the fingers; a prominent oval inner, and a longitudinally cleft outer metatarsal tubercle. Toes slightly dilated terminally and with a distinct rudiment of webbing; subarticular tubercles prominent; an oval inner, but no outer metatarsal tubercle. Tibio-tarsal articulation reaching beyond the tip of the snout.

Skin almost smooth or finely granulate above, with some larger pustules on

the upper eyelid and about the ear; a strong narrow fold from the posterior corner of the eye above the ear to about the middle of the flanks; a small \wedge -shaped fold in the middle of the back; smooth beneath; a small papilla on the heel.

Pale brown above, with some very small darker spots; a narrow, dark, transverse bar from eye to eye; loreal and temporal regions darker with obscure markings in the form of oblique lighter (reddish) bars radiating from the posterior half of the eye; sometimes a dark brown patch on the canthus rostralis and below the supratympanic fold; dorsal \wedge -shaped fold outlined with darker; limbs with alternately broader and narrower dark cross-bars; concealed surfaces of the thighs and tibia, and lower surfaces of the forearm, tarsus and foot dark brown. Lower surfaces white, the edge of the lower jaw brown.

Length from snout to vent: ♂ 42 mm.; ♀ 50 mm.

Male with a vocal sac opening by a slit on each side of the tongue, and nuptial pads of very small spines on the dorsal surface of the inner finger, except the terminal joint, on the inner metacarpal tubercle and along the inner dorsal side of the second finger; the pad on the first finger must contain many hundreds of spines. Mature females with the two inner fingers dilated as in *Limnodynastes*.

DISTRIBUTION: New South Wales, Queensland, Southern New Guinea.

SPECIMENS EXAMINED.

B.M. 90.7.28.1	imm. ♀.	Dunoon, Richmond River, N.S.W.	Helms. TYPE.
97.12.10.164	♂	Vikaiku, Brit. N. Guinea.	Loria.

***Lechriodus papuanus* (Roux).**

Phanerotis fletcheri papuana Roux, 1927, *Rev. suisse Zool.*, **34**, 4: 122, fig. 1 (Type locality:—Lake Sentani district, Dutch New Guinea).

Vomerine teeth in two long transverse series behind the choanae. Head as long as broad, moderately high. Snout blunt, slightly longer than the diameter of the eye; nostril quite close to the tip of the snout; canthus rostralis distinct; loreal region high, oblique, slightly concave; interorbital space narrower than the upper eyelid. Tympanum distinct, oval, a little higher than long, its height a little greater than half the diameter of the eye. Fingers and toes slightly dilated at their tips, the first finger equal to the second; subarticular tubercles very prominent. Toes distinctly webbed at the base; an elongate, oval inner metatarsal tubercle, about half as long as the inner toe. Tibio-tarsal articulation reaching a little beyond the tip of the snout.

Skin smooth and beset with small, pointed pustules, larger and rounded in places, for example on the upper eyelids; a small papilla on the heel. Dorsum with prominent, short, narrow folds; some on the interorbit form a \wedge , others form a pair of curved dorso-lateral lines from behind the orbits, convergent towards the middle of the back and then running parallel to the lumbar region, where there are also some short, oblique, secondary crests. Another fold runs from the eye above the tympanum to the middle of the flanks. Lower surfaces smooth except the median posterior portions of the thighs, which are granular.

Light grey above with black or grey-black spots and patches. All the dorsal folds are outlined with darker and the orbito-tympanic fold is bordered beneath with a dark patch which covers the upper half of the tympanum; below the end

of this glandular line, behind the fore-limbs, one or two black spots. Several broad, dark grey bars on the sides of the snout, one at the tip, one beneath the eye and another, smaller, between the two. Lower surfaces immaculate whitish-grey. Fore-limb grey with some little black dots on the anterior surface of the arm; fore-arm with two broad, dark grey annuli anteriorly and behind and on the elbow with longitudinal, blackish-grey marking. Fingers annulate with blackish grey, light grey beneath. Hind-limb grey; thighs with two indistinct darker bars above, blackish brown beneath and on the anal region, this colour sharply defined above and beneath. Tibia with a faintly indicated, darker, oblique bar. Knee, a line along the outer edge of the tibia, heel and lower surface of the tarsus black; lower surfaces of the foot and toes dark grey (after Roux).

Immature ♀: 23 mm.

DISTRIBUTION: near Lake Sentani, Dutch New Guinea.

A single example of this form is the only one known and its describer thought that it was a characteristic Papuan representative of *L. fletcheri*. But the only Papuan specimen of *fletcheri* available to the present author exactly resembles the type from New South Wales and entirely lacks the dorso-lateral folds described in the type of *papuanus*. Accordingly it seems probable either that there are two distinct species, or that further material will show a much greater range of variation than is at present known; there is no evidence in favour of the recognition of subspecies.

Lechriodus platyceps sp. n.

Asterophrys melanopyga (non Doria, 1875) Peters & Doria, 1878, *Ann. Mus. Stor. nat. Genova*, 13: 417.

Batrachopsis melanopyga Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 439 (part); Boettger, 1894, *Denkschr. med. Naturw. Ges. Jena*, 8: 112; Lucas, 1898, *Proc. Linn. Soc. N.S.W.*, 23: 359; van Kampen, 1923, *Amph. Indo-Austr. Archip.*: 17 (part).

Lechriodus melanopyga van Kampen, 1906, *Nova Guinea*, 5: 163, 178; Barbour, 1912, *Mem. Mus. comp. Zool. Harv.*, 44: 177; Fry, 1913, *Mem. Queensland Mus.*, 2: 48; *idem*, 1915, *Proc. roy. Soc. Queensland*, 27, 4: 73, pl. i, figs. 1, 2; Nieden, 1923, *Das Tierreich, Anura* I: 49 (part), figs. 105, 106; Noble, 1931, *Biol. Amphib.*: 113, fig. 38.

Holotype a female, number 76.7.18.6 in the British Museum, from Arfak, Dutch New Guinea; collected by A. A. Bruijn.

Vomerine teeth in curved series which do not extend laterally beyond the choanae. Head broad and flat, considerably broader than long, its width contained less than 2.5 times in the length from snout to vent. Snout rounded, not prominent, 1.6 times as long as the eye, with angular canthus rostralis and oblique, very slightly concave loreal region; nostril 1.2 times as far distant from the eye as from the tip of the snout; upper eyelid 1.5 times the width of the inter-orbit; tympanum distinct, vertically oval, its vertical diameter $\frac{3}{4}$ the length of the eye. Fingers moderately long, the first a little shorter than the second and both with strong lateral fringes which do not continue proximally beyond the subarticular tubercles; the latter are well developed but the supernumerary tubercles at the base of each finger are merely indicated; a large, prominent inner metacarpal tubercle, containing a cartilaginous prepollex, and a small indistinct outer. Toes with small terminal discs and a rudiment of webbing; subarticular tubercles well developed; a small oval inner, but no outer metatarsal tubercle. Tibio-tarsal articulation reaching the tip of the snout.

Skin regularly and profusely beset with small round pustules which may

form bead-like chains especially on the flanks; some larger papillae on the upper eyelid, about the ear and one on each heel. A straight dermal fold from the posterior corner of the eye above the tympanum to the flanks, and a narrow linear fold from the upper eyelid convergent towards the middle line about the middle of the back and then slightly divergent and forming a sinuous line to the end of the coccyx; a slight curved fold across the interorbit. Smooth beneath.

Pale brown above; upper surface of the snout to the interorbital fold lighter, the fold itself dark-edged. An irregular dark brown band beneath the canthus rostralis and supratympanic fold; a few dark spots beneath the eye and on the flanks, especially in the axillae and groins; a faint, light marking on each side of the back in the angles where the dorso-lateral folds approach one another and then diverge. Limbs with narrow transverse cross-bars. Concealed surfaces of thighs and tibiae and lower surfaces of the fore-arms, tarsi and feet dark brown. Lower surfaces whitish, the edge of the lower jaw and gular region freckled with brown.

. Length from snout to vent : 79 mm.

PARATYPES.

B.M. 78.2.11.5	♂	New Guinea.	(Boucard.)
1920.12.21.1-2	♂, ♀	South of Geelvinck Bay, 3700 ft.	Pratt.
Mus. Amsterdam	juv.	Upper Tor River, Northern New Guinea.	Gjellernp.
Mus. Leiden 4234	♂	Haddam (Hatam), Arfak Mts.	Beccari.

These specimens agree with the holotype in general morphological characters and colour with the exception of one or two details. The pustules are usually more numerous and prominent, often forming lines, especially on the legs, where they outline the transverse bars of colour; the tibio-tarsal articulation usually extends a little beyond the tip of the snout, the prepollex may be ossified, and the dark colour of the concealed surfaces of the hind-limbs is broken up into spots and dots. The first and second fingers of females are spatulate as described but those of the males are cylindrical, but with nuptial pads composed of relatively large spines; one such pad occupies the dorsal surface of the inner finger, except the terminal joint, a smaller one is situated on the end of the inner metacarpal tubercle and a third on the inner edge of the second finger at its base; the largest patch does not contain more than about 180 spines. Male with a vocal sac.

Largest ♂ 70 mm.; ♀ 96 mm.

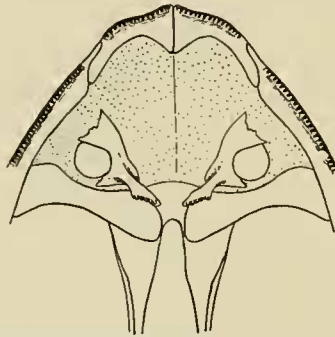
Fry (1915 : 74) draws attention to the fact that specimens from New Guinea had a much broader head than the type of *melanopyga*, and this difference, together with some others already noted, suggests that the two are not conspecific. The width of the head cannot be an age-character, for two of Fry's specimens measuring only 45 and 47 mm. characterized by the broad head are no larger than the narrow-headed examples of true *melanopyga* recorded from the Aru Islands, and the juvenile specimen from the Tor River, measuring only 21.5 mm. from snout to vent, has a relatively broader head than an adult *melanopyga*. The species *platyceps* has been recorded from the following localities in New Guinea: Arfak Mts.; south of Geelvinck Bay; Mansinam; Hatam; Mamberamo River; Idenburg River; Tor River; St. Joseph's River; Fife Bay.

ADELOTUS Ogilby.

Cryptotis (nec Pomel, 1848, nec Dana, 1852) Günther, 1863, *Ann. Mag. nat. Hist.*, (3), **11** : 27 (Type species :—*Cryptotis brevis*) ; Cope, 1865, *Nat. Hist. Rev.*, n.s., **5** : 107 ; *idem*, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6** : 80 ; Steindachner, 1867, *Reise Novara, Amph.* : 30 ; Keferstein, 1868, *Arch. Naturgesch.*, **34** : 267 ; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 262 ; Cope, 1889, *Bull. U.S. nat. Mus.*, **34** : 295 ; Noble, 1931, *Biol. Amph.* 498.

Adelotus (substitute name for *Cryptotis* Günther) Ogilby, 1907, *Proc. roy. Soc. Queensland*, **20** : 32 ; Nieden, 1923, *Das Tierreich, Anura I* : 538 ; Noble, 1931, *Biol. Amph.* : 498 ; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 23.

Skull elongate, the pars facialis of the maxilla forming a long edentulous suture with the pre-maxilla (text-fig. 7). Maxillary teeth present. Prevomer bounding the choana anteriorly and mesially, with a short, oblique process directed backwards bearing a short row of teeth and partially overlying the mesial end of the palatine. Dentary with a pseudo-tooth at its anterior end, small in females, very large and tusk-like in adult males. Fronto-parietals forming a



TEXT-FIG. 7.—Anterior cranial elements of *Adelotus brevis*. $\times 3$. (From beneath.)

median suture. Ear fully developed. Vertebrae procoelous, the condyle incompletely ankylosed and the notochord persistent ; sacral diapophyses slightly dilated ; urostyle articulating by 2 condyles ; 7 pre-sacral vertebrae (1 + 2 fused). Omosternum well developed, cartilaginous ; sternum broad, cartilaginous, notched but not bifid posteriorly ; procoracoids broad. Terminal phalanges simple.

Distal tendon of the m. semitendinosus perforating the gracilis complex distally. Alary processes of the hyoid expanded distally, narrower proximally.

Pupil horizontal with a ventral angle ; tongue oval or subcircular, partly free behind. Toes not dilated distally, with a rudiment of web.

***Adelotus brevis* (Günther).**

Cryptotis brevis Günther, 1863, *Ann. Mag. nat. Hist.*, (3), **11** : 27, pl. 4, fig. B (Type locality :—Clarence River, N.S.W.) ; Krefitz, 1865, *Pap. Proc. roy. Soc. Tasmania* : 17 ; *idem*, 1867, *Cat. Industr. Prod. N.S.W., Add.* : 107 ; Steindachner, 1867, *Reise Novara, Zool., Amph.*, 30 ; Günther, 1868, *Proc. zool. Soc. Lond.* : 480 ; Keferstein, 1868, *Arch. Naturgesch.*, **34** : 268 ; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 386 ; *idem*, 1890, *op. cit.*, (2), **5** : 609-671 ; *idem*, 1892, *op. cit.*, (2), **7** : 8 ; *idem*, 1894, *op. cit.*, (2), **8** : 525, 527, 529 ; Lucas & le Souef, 1909, *Anim. Austral.* : 275 ; Andersson, 1913, *K. Svenska Vetensk.-Akad. Handl.*, **52**, 4 : 11.

Adelotus brevis Ogilby, 1907, *Proc. roy. Soc. Queensland*, **20** : 32 ; Nieden, 1923, *Das Tierreich, Anura I* : 538, figs. 371, 372 ; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 23.

Head strongly depressed and enlarged in the male, subtriangular, broader than the body; not broader than the body and more rounded in females. Vomerine teeth in two short, oblique series behind the level of the choanae. Snout rounded, slightly prominent, 1.8 to 2.0 and 1.4 to 1.6 times as long as the eye in males and females respectively; nostril a little nearer the eye than the end of the snout; interorbital space as broad as, or a little broader than the upper eyelid. Tympanum hidden, but when uncovered by dissection vertically oval, its horizontal diameter about half that of the eye. Fingers moderately long, with a faint rudiment of web; in females the first and second are strongly spatulate with a thick fleshy fringe along their preaxial margins; subarticular tubercles prominent; two prominent rounded metacarpal tubercles. Toes moderate, with a slight rudiment of web; subarticular tubercles prominent; metatarsus with rows of small pustules; a small, slightly oval inner metatarsal tubercle and a much smaller outer situated at the base of the fourth metatarsal. Tibio-tarsal articulation reaching the tympanic region or the posterior corner of the eye.

Skin more or less warty above, particularly on the upper eyelids and hind limbs; lower surfaces smooth.

Pale brown to olive or grey above with scattered darker blotches and lighter dots; synciput lighter. The most constant dark markings are a bar from the tip of the snout through the nostril to the eye, sometimes continued as a straight, oblique line from the posterior corner of the eye to the angle of the mouth and edged beneath with lighter, a vertical bar beneath the eye and a large sub-quadrangular or triangular blotch whose anterior edge connects the centres of the upper eyelids. Limbs regularly cross-barred above. Lower surfaces dark brown or blackish with small white (?) flecks on the gular region and bold spots on the belly and lower surfaces of the femur and tibia; groin and concealed surfaces of the tibia, metatarsus and foot with large pink or crimson spots.

Male with a vocal sac but apparently without nuptial pads. Premaxillary and anterior maxillary teeth strongly enlarged.

Length from snout to vent: ♂ 44 mm.; ♀ 37 mm.

DISTRIBUTION: New South Wales (East of the Dividing Range), and Southern Queensland.

SPECIMENS EXAMINED.

B.M. 63.6.16.95	♂, ♀	Clarence River, N.S.W.	Krefft. COTYPES.
64.7.8.8	♀	Port Macquarie, N.S.W.	"
		(<i>vide</i> Fletcher).	
70.6.26.22	2 ♂♂, 6 ♀♀	Ditto.	"
70.6.26.22	♂ skel.		"
1935.3.1.1-4	2 ♂♂, 2 ♀♀	Dorrigo, N.S.W.	Heron.
Austr. Mus. R. 11382	♀, 3 juvs.	Comboyne, N.S.W.	

Breeding habits unknown. The inner fingers of the female suggest a foam-beating habit similar to that of *Limnodynastes*, but the apparent absence of nuptial pads in the male suggests that pairing may take place on land.

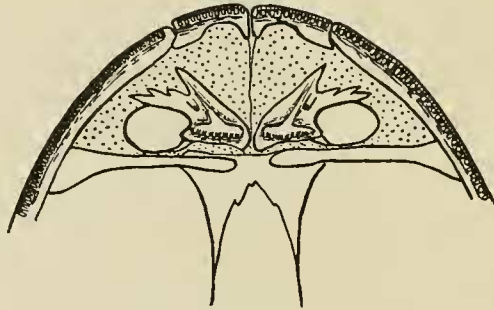
HELEIOPORUS Gray.

- Rana* Shaw, 1795, *Nat. Miscellany*, 6: pl. 200; Schneider, 1799, *Hist. Amphib.*, 1: 129.
¹*Heleioporus* Gray, 1841, *Ann. Mag. nat. Hist.*, 7: 91 (Type species:—*H. albopunctatus*);
 Gray, 1841, in Grey, *Journ. Exped. Austral.*, 2: pl. i; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 38; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 271.
¹*Heleioporus* Gray, 1841, in Grey, *Journ. Exped. Austral.*, 2: 447; Cope, 1865, *Nat. Hist. Rev.*, n.s., 5: 108; *idem*, 1866, *J. Acad. nat. Sci. Philad.*, (2), 6: 89, 94; Kieferstein, 1868,

¹ In the specific synonymies these alternative spellings are not recorded separately.

Arch. Naturgesch., **34** : 269; Cope, 1889, *Bull. U.S. nat. Mus.*, **34** : 312; Fry, 1914, *Rec. W. Aust. Mus.*, **1** : 208; Nieden, 1923, *Das Tierreich, Anura I* : 525; Waite, 1929, *Rep. Amph. S. Australia* : 240; Noble, 1931, *Biol. Amph.* : 497.
Heleioforus (err.) Krefft, 1865, *Mon. Not. roy. Soc. Tasmania* : 17.
Perialia Gray, 1845, in Eyre, *Journ. Exped. C. Austral.*, **1** : 407 (Type species:—*Perialia eyrei*); Cope, 1889, *Bull. U.S. nat. Mus.*, **34** : 312.
Neobatrachus Peters, 1863, *Mber. Akad. Berlin* : 234 (Type species:—*N. pictus*); Cope, 1866, *J. Acad. Nat. Sci. Philad.*, (2), **6** : 94.
Philocryphus Fletcher, 1893, *Proc. Linn. Soc. N.S.W.*, (2), **8** : 233. (Type species:—*P. flavoguttatus*); Fry, 1914, *Rec. W. Aust. Mus.*, **1** : 208; Noble, 1931, *Biol. Amph.* : 497.

Maxillary teeth present. Prevomer well developed with a posterior dentigerous process which does not quite reach the palatine (text-fig. 8); a very large fronto-parietal foramen, ethmoid entire. Ear fully developed. Vertebrae procoelous, but the condyle incompletely ankylosed; notochord persistent; sacral diapophyses slightly dilated; urostyle articulating by two condyles; 7 presacral vertebrae. Omosternum small, cartilaginous, sternum undivided or notched posteriorly, cartilaginous or calcified mesially. Terminal phalanges simple.



TEXT-FIG. 8.—Anterior cranial elements of *Heleioforus albopunctatus*. $\times 2.5$.
 (From beneath.)

Distal tendon of the m. semitendinosus passing ventral to the tendon of the mm. graciles. Alary processes of the hyoid expanded distally, but with a narrow stalk proximally; cricoid cartilage complete; oesophageal process of the cricoid slender; m. omohyoideus present; mm. sternohyoideus and petrohyoidei attached at the edges of the hyoid.

Pupil horizontal, but with a downwardly directed angle ventrally. Tongue large, broadly oval, half free behind. Toes more or less webbed.

The status of *Philocryphus* with regard to *Heleioforus* has been in dispute for some time. Fletcher himself (1897 : 679) was doubtful whether it could be maintained, but Fry (1914 : 206) advanced reasons for continuing to retain the two apart; Fry's views have been accepted by the latest commentator (Loveridge, 1935 : 17), but Noble (1931 : 497), though maintaining the two, can only distinguish them by the degree of distinctness of the tympanum. This can be so extremely variable and is so dependent on preservation that its value seems very problematical. Actually *albopunctatus* and *australiacus* are so closely allied that in their young stages they are almost indistinguishable, and the characters suggested by Fry for their generic separation are almost all age-characters; his skeleton of *albopunctatus* was almost certainly that of a juvenile. Fletcher himself at one time (1889 : 376) referred one of his co-types of *flavoguttatus* (= *australiacus*) to *albopunctatus*, and Boulenger (1882 : 272) was unable

to distinguish juveniles of *australiacus* from *albopunctatus*. Examination of all the material now in the British Museum suggests that some 8 forms are valid, which may be distinguished by the key given below. If any generic separation should be possible, or desirable, the division should apparently be between sections I and II. The first of these, containing small species with an undivided sternum and with diffuse nuptial pads, would then be known as *Neobatrachus* Peters, of which *N. pictus* is the genotype.

SYNOPSIS OF THE SPECIES.

- I. Sternum always cartilaginous, not bifid posteriorly. Small species, the males with a diffuse nuptial pad. Metatarsal tubercle usually edged with black or dark brown.
 - A. Toes $\frac{2}{3}$ to fully webbed.
 - (1) Eye not longer than its distance from the tip of the snout. A colour pattern of dark insuliform spots or irregular marblings on a light ground.
 - (a) Skin warty above (spinulose in breeding males); metatarsal shovel completely black *H. pictus*.
 - (b) Skin smooth or with spinules in breeding males; metatarsal shovel edged with brown or not coloured *H. centralis*.
 - (2) Eye longer than its distance from the tip of the snout. Colour pattern consisting of light bifurcating lines on a dark ground. Skin quite smooth, but thick and glandular; metatarsal shovel edged with brown *H. wilsmorei*.
 - B. Toes not more than $\frac{1}{3}$ webbed, except in males at the breeding season, when the web continues as a tapering fringe to the tip of each toe *H. pelobatoides*.
- II. Sternum of the adult calcified and bifid posteriorly. Large species, the males with large, conical, black horny spines on the dorsal surfaces of the inner fingers.
 - A. Tip of the fifth toe not reaching beyond the nostril; at most a single, conical tubercle at the anterior corner of the eye; flanks not more warty than the dorsum; a pattern of regular circular cream-coloured (white) spots on a dark ground colour *H. albopunctatus*.
 - B. Tip of the fifth toe reaching the tip of the snout or a little beyond; a fimbriated flap at the anterior corner of the eye; flanks more granular than the dorsum.
 - (1) Size large (up to 80 mm.); tympanum of adult large ($\frac{2}{3}$ - $\frac{3}{4}$ the eye) and subcircular; dorsum uniform purple-brown; flanks liberally yellow-spotted *H. australiacus*.
 - (2) Size moderate (up to 59 mm.); tympanum of adult vertically oval, rather indistinct, $\frac{1}{2}$ - $\frac{2}{3}$ the diameter of the eye; dorsum brown marbled with grey or yellowish irregular markings *H. cyr ei*.
- III. *Incertae sedis* *H. sudell* .

Heleioporus pictus (Peters).

Neobatrachus pictus Peters, 1863, *Mber. Akad. Berlin*: 235 (Type locality:—near Adelaide); Keferstein, 1868, *Arch. Naturgesch.*: 262.

N. fictus (err. typ.) Krefft, 1865, *Pap. roy. Soc. Tasmania*: 17.

Heleioporus pictus Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 272; Lucas, 1892, *Proc. roy. Soc. Victoria*, 4: 61; Fletcher, 1890, *Proc. Linn. Soc. N.S.W.*, (2), 5: 672-675; *idem*, 1891, *op. cit.*, 6: 271-273; *idem*, 1894, *op. cit.*, 8: 529, 531; *idem*, 1898, *op. cit.*, 22: 679; Lucas & le Souef, 1909, *Anim. Austral.*: 281, fig.; Fry, 1914, *Rec. W. Aust. Mus.*, 1: 207, fig. 11; Nieden, 1923, *Das Tierreich, Anura* 1: 527 (part); Waite, 1929, *Rept. Amph. S. Austral.*: 249 (part), fig. 177.

Vomerine teeth in transverse series between the choanae. Snout rounded, as long as the eye; canthus rostralis rounded; loreal region oblique, and very slightly concave; nostril equidistant from the eye and the end of the snout, or a little nearer the latter; interorbital space $\frac{3}{4}$ the width of the upper eyelid; tympanum indistinct, vertically oval, its maximum diameter about half the length of the eye. Fingers moderate, the first extending beyond the second, which extends as far as, or very slightly beyond, the fourth; the length of the third, along its mesial side, very slightly shorter than the eye. Toes $\frac{3}{4}$ or fully webbed, the membrane extending to the tips of all of them. Subarticular tubercles scarcely developed on the feet; a strongly compressed, prominent metatarsal tubercle about as long as its distance from the tip of the inner toe, covered with a black horny sheath. Tarso-metatarsal articulation reaching the eye, the tip of the outer toe reaching the tip of the snout.

Skin with irregular small warts above; smooth beneath; anal region feebly granular.

Greyish or pale brown above with numerous insuliform dark brown spots or marblings, of which the most constant are an oval canthal stripe, a triangular mark between the eyelids and a short, oval mark behind the upper eyelid; lower surfaces white except the sides of the throat and edges of the lower jaw, which may be blotched or washed with brown; anal granules white-tipped. Usually a narrow, vertebral line. In life (Fletcher, 1891: 273) there is sometimes a yellow wash about the thighs and upper arms. Iris silvery or golden, veined with black and with a dusky streak from the anterior corner to the centre of the pupil.

Breeding male with a distended throat but without definite vocal sacs, with a diffuse, brown, nuptial pad on the upper surfaces of the first and second fingers and with small, horny brown spinules scattered over the dorsal surfaces and on the outer edge of the tarsus and fifth toe.

Length from snout to vent: ♂ 36 mm.; ♀ 47 mm.

DISTRIBUTION: New South Wales, west of the dividing range; Victoria; S. Australia in the south and east; ? S. Queensland; possibly also in eastern districts of West Australia.

The records of this species from Central and N.W. Australia appear to refer to a distinct, but related, form (*vide H. centralis*). *H. sudelli* Lamb, from Warwick, S. Queensland, is usually placed as a synonym of *pictus*, but several points in the description, notably the approximation of the nostril to the eye, and the equally long first and second fingers, make this disposition seem very doubtful.

SPECIMENS EXAMINED.

B.M. 74.4.29.1283	♀	Sandhurst, Victoria.	[Beddome.]
99.2.14.1	♀	Melbourne.	Degen.
64.10.27.46	juv.	Ryalstone, N.S.W.	Krefft.
92.9.16.5	♂	Urana, N.S.W.	Fletcher.
R.R. 1937.7.29.10	♂ skel.	"Australia."	Green.

Heleioporus centralis sp. n.

Heleioporus pictus (non Peters) Spencer, 1896, *Rep. Horn Exp. C. Austral.*, 2, (Zool.) : 166, pl. 13, fig. 2, pl. 14, figs. 10-13; Spencer & Gillen, 1912, *Across Australia*, 1 : 59, pl. i, fig. c; ? Andersson, 1913, *K. Svenska Vetensk. Akad. Handl.*, 52, 4 : 16; Harrison, 1922, *Aust. Zool.*, 3, 1 : 33; Nieden, 1923, *Das Tierreich, Anura* 1 : 527, figs. 358-361 (part); Waite, 1929, *Rept. Amph. S. Austral.* : 249 (part).

Holotype a male, number 1905.10.31.47, from 100 miles east of Lake Eyre, collected by H. J. Hillier, Esq.

Vomerine teeth in slightly oblique series between the choanae. Snout rounded, as long as the eye; canthus rostralis rounded; loreal region oblique, but not concave; nostril a little nearer the tip of the snout than the eye; inter-orbital space $\frac{3}{4}$ the width of the upper eyelid; tympanum very indistinct, vertically oval, its maximum diameter about half the length of the eye. Fingers rather short, the first extending a little beyond the second, which extends well beyond the fourth; the length of the third, along its mesial side nearly as long as the eye. Toes fully webbed, the membrane extending to the tips of all of them; subarticular tubercles very feeble; a compressed inner metatarsal tubercle as long as its distance from the tip of the inner toe. Tarso-metatarsal articulation reaching the tympanic region, the tip of the outer toe marking the anterior corner of the eye.

Skin smooth above and below, except for the secondary sex characters, which consist of a diffuse nuptial pad on the first and second fingers, and small papillae with black horny spinules scattered over the dorsum and along the outer edge of the tarsus and foot.

Pale grey above with very obscure dusky mottling and a narrow white vertebral line. Lower surfaces white.

Length from snout to vent : 42 mm.

The paratypes are a male and female from Central Australia, probably Charlotte Waters, collected by the Horn Expedition (B.M. 97.1.20.32-33) and two females from "Central Australia" (B.M. 1908.5.28.66-67).

These four specimens scarcely differ from the type in their morphological characters. The webbing of the toes may be somewhat more emarginate, giving an appearance of $\frac{3}{4}$ web only, and the hind limb may be slightly longer, so that the metatarsal tubercle almost reaches the posterior corner of the eye and the tip of the outer toe extends a little beyond the eye. Both specimens collected by the Horn Expedition have the metatarsal tubercle narrowly black-edged (this colouring is much less extensive than in *pictus*), and in all the specimens it is longer than its distance from the tip of the inner toe.

The colour pattern is more distinct than in the type, but its intensity is very variable. When fully developed it is similar to that in the coloured plate illustrating Spencer's account (1896 : pl. 13, fig. 2) of the species. The largest male and female, both from Charlotte Waters, each measures 50 mm. from snout to vent.

These Central Australian frogs differ from the eastern and southern species, *pictus*, in their rounder, shorter snouts, shorter legs, smooth skin and the absence or feeble development of the pigmented sheath on the metatarsal tubercle. It seems probable that the specimens from N.W. Australia (Mowla Downs, Kimberley Division) recorded by Andersson (1913 : 16) as lacking the dark metatarsal tubercle really belong to this species; Loveridge's suggestion (1935 : 16) that they might be juvenile *albopunctatus* is untenable, for Andersson described the nuptial characters of the male, and these are quite unlike those of *albopunctatus*.

In addition to the above-mentioned specimens the British Museum has a series of tadpoles which accord with Spencer's description (1896); the labial teeth are in $\frac{4}{3}$ series.

***Heleioporus wilsmorei* sp. n.**

Holotype a female, number 1937.7.22.3 from Wirarga, N.E. of Yalgoo, Murchison, W. Australia; collected by G. E. Nicholls.

Vomerine teeth in transverse series on a level with the posterior borders of the choanae. Head short and high. Snout rounded, $\frac{3}{4}$ the length of the eye; nostril slightly nearer the tip of the snout than the eye; canthus rostralis rounded; loreal region nearly vertical; interorbital space $\frac{2}{3}$ the width of the upper eyelid; tympanum quite indistinct, but when exposed by dissection, vertically oval, its maximum diameter about $\frac{1}{3}$ the length of the eye. Fingers moderate, the first extending beyond the second, which extends well beyond the very short outer; third, measured along its mesial side, as long as the eye. Toes $\frac{3}{4}$ webbed, the membrane thick and fleshy leaving the tips of the third to fifth free; no sub-articular tubercles on the feet; inner metatarsal tubercle compressed, as long as its distance from the tip of the inner toe and black-edged. Tarso-metatarsal articulation reaching the tympanic region, the tip of the outer toe marking the centre of the eye.

Skin quite smooth, but very thick and glandular above; smooth beneath; a deep furrow below the vent.

Chocolate brown above, with a series of light markings as follows: a narrow mid-dorsal line; a longitudinal row of spots down the centre of the upper eyelid to the posterior corner where they are continued as light lines which run backwards to the vent, sending off two branches on the way; the first of these arises above the tympanic region and runs obliquely backwards to the anterior part of the flanks, and the second arising vertically above the axilla runs obliquely to the groin. Lower surfaces uniform white.

Length from snout to vent: 50 mm.

The paratype is a female, in bad condition, found dead near Lakeside, Calgoorlie, October 18, 1921 (B.M. 1937.7.22.4). It agrees with the holotype in every way. Professor Nicholls has seen a third specimen from the coastal zone north of Geraldton.

This species, which appears to be confined to the eastern parts of West Australia, east of the Darling Range, is one of the *pictus* group, but is distinguished by its much deeper head, large eye, shorter outer digits and very distinctive colour pattern.

***Heleioporus pelobatoides* Werner.**

Heleioporus albopunctatus var. *pelobatoides* Werner, 1914, *Fauna S.W. Austral.*, 4, 10, Amph.: 418 (Type localities:—Beverley and Broome Hill, W. Australia).

Heleioporus pelobatoides Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 15.

Heleioporus eyrei (non Gray) Loveridge, 1935, *loc. cit.*

Vomerine teeth in transverse or slightly oblique series between the choanae. Snout rounded, as long as the eye; nostril midway between the eye and the tip of the snout; canthus rostralis rounded; loreal region very oblique, not concave; interorbital space $\frac{3}{4}$ the width of the upper eyelid. Tympanum indistinct in non-breeding individuals, but becoming very distinct in males at the breeding season; in females and juvenile males it is vertically oval, its maximum diameter

$\frac{2}{3}$ that of the eye, but in adult males it is subcircular, though its diameter is similar. Fingers moderate, the first extending slightly beyond the second, which extends very slightly beyond the fourth; third, measured along its median side, a little longer than the eye; subarticular tubercles well developed and the palm of the hand beset with numerous small rounded tubercles. Toes in non-breeding adults about $\frac{1}{4}$ webbed, but in juveniles at metamorphosis the webbing is more extensive and males in nuptial dress have it carried to the tips of the toes as a fleshy, tapering fringe; subarticular tubercles small; a compressed inner metatarsal tubercle as long as or longer than its distance from the tip of the inner toe and edged with brown. Tarso-metatarsal articulation reaching the centre or anterior border of the eye, the tip of the outer toe extending well beyond the tip of the snout.

Skin very warty above, especially on the head; smooth beneath; anal region feebly granular.

Pale grey to dark brown above with irregular darker blotches or marblings. The most constant are a canthal blotch, a triangular interorbital mark and a pair of very large dorso-lateral blotches on each side of the middle of the back. The warts and the anal granules are frequently white-tipped and a light dorsal line may be present. Lower surfaces white or yellowish, the edges of the lower jaw and sides of the throat washed with brown and stippled with white.

Males at the breeding season, in addition to the extension of the web already described, have a diffuse nuptial pad on the first and second fingers, and scattered horny spinules over all the dorsal surfaces.

A nocturnal species, burrowing by day; normally the burrow is about 2 ft. deep, but in damp localities the frog may be found in shallow cavities beneath logs. Eggs are laid in the burrow and the embrace is lumbar (*vide* Prof. G. E. Nicholls *in litt.*).

This species appears to be confined to the wetter south-western parts of West Australia and is the analogue of the eastern *pictus*, with which it agrees in habitus, leg-length and skin texture. The species from the central, dry zone is more globular in habitus, with a shorter, blunter snout, higher head, and shorter limbs and digits; in fact it appears to be more highly modified for a cryptozoic existence.

SPECIMENS EXAMINED.

B.M. 1931.7.1.18-23	♂, 4 ♀♀	Mt. Toolbrunup.	Baldwin.
1931.7.1.13-17	2 ♀♀, 3 juvs.	"	"
1931.7.1.5-8	4 juvs., 1 larva	"	"
M.C.Z. 19430	♂ (breeding)	Tambellup.	
18219	juv.	Pindawa.	Schevill.

The specimen from Pindawa is one of the series referred by Loveridge to *H. eyrei*, which he considered to be the same as the species more generally known as *H. pictus*. But *eyrei* and *pictus* are certainly not conspecific, and these West Australian frogs, which are very immature, cannot be distinguished from the juveniles from Mt. Toolbrunup, which are almost certainly *pelobatoides*. Loveridge was led to believe that two species were present in his material owing to the fact that his single adult was a male in nuptial dress. With the exception of the nuptial characters of digital pads and dermal asperities, this breeding male only differs from the Mt. Toolbrunup male in the greater amount of digital webbing and more distinct tympanum; but a non-breeding male has a larger, rounder,

more distinct tympanum than females of the same collection, so that this character is obviously variable and may well be seasonal; the condition of the webbing is believed to be similarly variable.

Heleioporus albopunctatus Gray.

Heleioporus albopunctatus Gray, 1841 (April), *Ann. Mag. nat. Hist.*, **7** : 91 (Type locality:—Western Australia); Gray, 1841, in Grey, *Journ. Exped. W. Austral.*, **2** : 447; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 39 (part); Günther, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 55; Krefft, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.* : 107; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 271 (part); ?? Lucas, 1892, *Proc. roy. Soc. Victoria*, **4** : 61; Fletcher, 1893, *Proc. Linn. Soc. N.S.W.*, (2), **8** : 232; *idem*, 1898, *op. cit.*, **22** : 678; Lucas & le Souef, 1909, *Anim. Austral.* : 281; Werner, 1914, *Fauna S.W. Austral.*, **4**, 10, Amph. : 417; Fry, 1914, *Rec. W. Aust. Mus.*, **1** : 204; Harrison, 1922, *Aust. Zool.*, **3**, 1 : 32; Nieden, 1923, *Das Tierreich, Anura I* : 526; Glauert, 1929, *J. roy. Soc. W. Aust.*, **15** : 44; Trewavas, 1933, *Phil. Trans. roy. Soc. London*, **222**, B : 433, figs. 23, 24; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 14.
Heleioporus alboguttatus (laps. cal.) Gray, 1841, in Grey, *Journ. Exped. W. Austral.*, **2** : pl. 1, fig. 2; Günther, 1858, *Cat. Batr. Brit. Mus.* : 33 (footnote).
Heleioporus alleopunctatus (err. typ.) Krefft, 1865, *Mon. Not. roy. Soc. Tasmania* : 17.

Vomerine teeth in long transverse series between the choanae. Snout rounded, as long as the eye; canthus rostralis rounded; loreal region oblique, not concave; nostril equidistant from the eye and the end of the snout; inter-orbital space about $\frac{2}{3}$ the width of the upper eyelid; tympanum usually indistinct, vertically oval, its horizontal diameter $\frac{1}{3}$ to $\frac{1}{2}$ the length of the eye. Fingers moderate, the first longer than the second, which is longer than the fourth; subarticular tubercles well developed, and the palm with many tubercles in addition to an inner and group of three outer metacarpal tubercles; one or two tubercles between the first and second and second and third fingers. Toes with a distinct rudiment of fleshy web; third extending beyond the fifth; a large, compressed inner metatarsal tubercle; metatarsal tubercle reaching the tympanic region and the fifth toe the anterior corner of the eye or the nostril.

Skin regularly shagreened above and on the flanks; smooth beneath; anal region granular. A large parotoid gland extending posteriorly to the middle of the flanks, and a similar glandular complex on the antero-ventral surface of the thigh close to the groin.

Dark purple- or chocolate-brown above, regularly beset with circular cream-coloured spots. A light vertical bar may be present on the tip of the snout and a light diagonal stripe from below the eye to the angle of the mouth. White beneath except for the throat, which may be lightly washed with brown.

Male in the breeding season with a series of black, horny, conical spines. The longest, situated on the metacarpo-phalangeal knuckle of the first finger has a bony core, which is articulated on the distal end of the first metacarpal; a series of much smaller, horny conical spines, but apparently without bony cores, are situated distal to the above-mentioned large one on the first finger, and a few may also be present on the second finger. No vocal sac.

Length from snout to vent : ♂ 68 mm. ; ♀ 69 mm.

DISTRIBUTION : West Australia east of the Darling Range and ? N. Territory.

This species appears to be confined to the west of Australia, and various eastern records have been regarded (Fletcher, 1893 : 233) as instances of faulty labelling. Some West Australian records of *albopunctatus* are probably based on examples of *eyrei*, and the Victoria record (Lucas, 1892) is probably due to a misidentification. None of the 13 adult examples of true *albopunctatus* (including the type) which the author has examined show any preocular dermal flap.

SPECIMENS EXAMINED.			
B.M. 41 (2) 211	♂	West Australia.	TYPE.
RR. 1936.12.3.128	♀	Port Essington, N.T.	Dr. Fleming.
		(?)	
96.1.30.9-11	3 juvs.	Geraldton, Chapman River.	Saunders.
1931.7.1.9	♂	Toolbrunup, S. W. Australia.	Baldwin.
1937.7.22.5-6	2 ♂♂	W. Australia.	Nicholls.
1937.7.22.7	♂	St. Ronan's Well, York, W. Austr.	"
1937.7.22.8-9	♂♀	St. Ronan's Well, York, W. Austr.	"
1937.7.22.10-11	♂♀	Bruce Rock, W. Australia.	"
1937.7.22.12-13	♂♀	Waad, nr. Meckering, W. Austr.	"
1937.7.22.14	♂	W. Australia.	"
1907.3.13.4	♂ skel.	" Australia."	Preston.

Heleioporus australiacus (Shaw).

- Rana australiacus* Shaw, 1795, *Nat. Miscellany*, 6 : pl. 200 (Type locality :—New Holland) ; Andersson, 1913, *K. Svenska VetenskAkad. Handl.*, 52, 4 : 3.
- Philocryphus australiacus* Fry, 1915, *Proc. roy. Soc. Queensland*, 27, 4 : 70 ; Harrison, 1922, *Aust. Zool.*, 3, 1 : 32 ; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 17.
- Rana spinipes* Schneider, 1799, *Hist. Amph.*, 1 : 129-139 (Type locality :—Islands of the ocean around Australia) ; Shaw, 1802, *Gen. Zoology*, 3 : 112.
- Heleioporus albopunctatus* (non Gray), Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), 4 : 376 ; *idem*, 1890, *op. cit.*, (2), 5 : 671 ; Werner, 1914, *Fauna S.-W. Austral.*, 4, 10, Amph. : 417 (part :—Lion Mill ?).
- Philocryphus flavoguttatus* Fletcher, 1893, *Proc. Linn. Soc. N.S.W.*, (2), 8 : 233 (Type localities :—Mt. Victoria, Blue Mts. ; Thornleigh ; Dural, near Paramatta ; near Manly) ; *idem*, 1894, *tom. cit.* : 530 ; Lucas & le Souef, 1909, *Anim. Austral.* : 282, fig. ; Steel, 1912, *Aust. Nat.*, 2 : 135 ; Fry, 1914, *Rec. W. Aust. Mus.*, 1 : 205, figs. 8a, 9.
- Heleioporus flavoguttatus* Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, 22 : 679 ; Nieden, 1923, *Das Tierreich*, Anura 1 : 528 (part).

Vomerine teeth in two long, transverse or slightly oblique series between the choanae. Sternum in juveniles a broad cartilaginous plate, notched posteriorly, but becoming calcified, the calcified style and posterior edge becoming distinctly bifurcate with increasing age. Head broad, depressed. Snout rounded, as long as the eye, with rounded canthus rostralis and very oblique loreal region ; nostril equidistant from the end of the snout and the eye, or a little nearer the latter ; interorbital space slightly narrower than the upper eyelid ; anterior corner of the eye with a fimbriated flap of skin, well-developed in adults, less so in half-grown examples and absent in the very young. Tympanum subcircular, its horizontal diameter $\frac{2}{3}$ to $\frac{3}{4}$ the length of the eye. Fingers well developed, the first a little longer than the second, which is a little longer than the fourth ; sub-articular tubercles large ; an oval inner, and a group of 3 outer metacarpal tubercles, as well as numerous palmar tubercles, of which the most constant are one each between the first and second and second and third fingers. Toes with a distinct, though slightly variable, rudiment of rather fleshy web ; outer toe variable in length, but always shorter than the third ; a very large compressed inner metatarsal tubercle. Tarso-metatarsal articulation reaching the eye, the tip of the outer toe extending to the tip of the snout or a little beyond.

Skin regularly shagreened above, more coarsely granular on the flanks ; a large parotoid glandular complex not easily distinguished externally, and a small oval gland on the antero-ventral surface of the thigh close to the groin. Lower surfaces smooth or wrinkled ; anal region granular.

Dark grey- or purplish-brown above ; frequently a vertical yellow bar on the tip of the snout ; warts of the flanks and posterior half of the upper lip yellow. Lower surfaces white except the throat of the male, which has a dusky wash or reticulation.

Male at the breeding season with a series of horny, conical spines on the dorsal surfaces of the first, and sometimes also the second and third fingers. The largest is situated on the metacarpo-phalangeal knuckle of the pollex and has a bony core. Both sexes are also more or less profusely covered with small black spinules. No vocal sac.

Length from snout to vent : ♂ 80 mm. ; ♀ 77 mm.

DISTRIBUTION : New South Wales (Cumberland County) and West Australia (Darling Range to Kojonup in the region of moderate rainfall).

SPECIMENS EXAMINED.

1925.8.24.1-2	♂♀	Hornsby, N.S.W.	(Rosenberg.)
1937.7.22.15-26	♂♀ and juvs.	New South Wales.	Harrison.
1937.7.22.27	♂	St. Ronan's Well, York, W.A.	Nicholls.

Heleioporus eyrei (Gray).

Perialia eyrei Gray, 1845, in Eyre, *Journ. Exped Centr. Austral.*, 1 : 407, pl. 2, fig. 3 (Type locality :—" On the banks of the River Murray " ¹).

Heleioporus albopunctatus (non Gray) Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 39 (part) ; Kesterstein, 1868, *Arch. Naturgesch.*, 34 : 269 ; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 271 (part) ; Werner, 1914, *Fauna S.-W. Austral.*, 4, 10, Amph. : 417 ; Dakin, 1920, *Aust. Zool.*, 1, 8 : 241 ; Nieden, 1923, *Das Tierreich, Anura I* : 526, fig. 357 ; Glauert, 1929, *J. roy. Soc. W. Aust.*, 15 : 44.

Heleioporus insularis Loveridge, 1933, *Occ. Pap. Boston Soc. nat. Hist.*, 8 : 92 (Type locality :—Rottneest Island) ; *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 15.

Vomerine teeth in two long, transverse series between the choanae. Sternum calcified in the adult and notched posteriorly. Head broad, depressed. Snout rounded, a little longer than the eye, with rounded canthus rostralis and oblique loreal region ; nostril equidistant from the eye and the end of the snout ; inter-orbital space a little narrower than the upper eyelid ; anterior corner of the eye with or without some small papillae. Tympanum more or less distinct, vertically oval, the annulus tympanicus with a vertical diameter $\frac{1}{2}$ to $\frac{2}{3}$ that of the eye. Fingers well developed, the first a little longer than the second, which is distinctly longer than the fourth ; subarticular tubercles prominent ; a prominent oval inner metacarpal tubercle (covering a bony prepollex in both sexes) and a group of smaller outer metacarpal tubercles ; numerous palmar tubercles and conical ones between the first and second, and second and third fingers. Toes with a rudiment of fleshy webbing, the outer shorter than the third ; a very large compressed inner metatarsal tubercle. Tarso-metatarsal articulation reaching the eye, the tip of the fifth toe extending to the tip of the snout or a little beyond.

¹ It has been suggested that this is the West Australian River Murray and not the better known river of the same name in South Australia. There is some evidence to support this view. Although the specimens are said to have been collected by Eyre, there is no proof that this is so, and Gray expressly states that " The British Museum has received from the different travellers various other species—" (*op. cit.* : 406). The types are entered in the register of 1843 as having been purchased from Turner (a dealer) and the locality is given as West Australia. Other frogs in the same collection are *Limnodynastes dorsalis dorsalis* and *Crinia signifera signifera*, of which the former does not occur in South Australia.

Skin shagreened above, more definitely tubercular on the flanks; a parotoid complex, not discernible externally, and a small oval gland on the antero-ventral surface of the thigh, close to the groin. Lower surfaces smooth. Anal region granular. Brown above, with irregular lighter (grey or yellowish) marblings, of which the most constant are a pair of oval spots above the shoulder and a vertical light bar on the tip of the snout; flanks and anal region sparsely dotted with yellow or white. Lower surfaces immaculate white except the throat of the male, which is slightly infusate.

Male without or with only a single spine on the metacarpo-phalangeal knuckle of the inner finger; no vocal sac.

Dimensions: ♂♂ 46-56 mm. (av. of 9 specs. 52 mm.); ♀♀ 48-59 mm. (av. of 8 specs. 53 mm.).

DISTRIBUTION: Coastal Zone of West Australia, west of the Darling Range, south to Albany county, but excluding the damp south-west corner. Rottnest Island; ? Northern West Australia.

The species, which has usually been confused with *albopunctatus*, is closely allied to *australiacus* and may prove to be a neotenic form of that species. In West Australia the three form a complex, of which *eyrei* occupies the dry zone to the west of the Darling Range, *australiacus* the relatively damp areas on both sides of the mountains and *albopunctatus* the dry zone to the east. The two latter occur together in the neighbourhood of St. Ronan's Well, but *eyrei* and *albopunctatus* meet in the south at Toolbrunup (circa 50 miles north of Albany).

Eggs laid in a frothy mass of jelly underground in April. Development proceeds within the egg until the external gills have been lost and the operculum developed; hatching is conditional upon the nest being flooded. A well-developed tadpole measures 58 mm., of which the head and body account for 26. Eyes and nostrils directed upwards, the latter much nearer a line connecting the anterior borders of the eyes than the end of the snout. Mouth terminal, directed downwards, lips with a single row of papillae, the upper widely interrupted in the middle; angles of the mouth with short, transverse rows bearing three or four papillae within the lips; mandibles powerful and finely serrated; three or four rows of labial teeth above, the inner two or three widely interrupted mesially; three below, the outer shortest and the innermost narrowly interrupted in the middle. Spiraculum sinistral, situated towards the ventral side. Anus dextral, slightly anterior to the base of the tail. Young at metamorphosis 23 mm. from snout to vent.

SPECIMENS EXAMINED.

B.M. 62.7.29.14	♀	(" Sydney ")	Krefft. ¹
R.R. 1936.12.3.129	♂	Port Essington, N.T. (?)	Fleming.
69.7.27.6	♀	N.W. Australia.	(Higgins.)
43.5.19.71-74	juvs.	Murray River (West Australia ?)	Eyre. TYPES.
1931.7.1.10	♀	Mt. Toolbrunup, W.A.	Baldwin.
1931.7.1.11-12	Larvae.	" " "	"
1931.7.1.2-4	♂, ♀♀	" " "	"
44.2.26.11	♀	Swan River, W.A.	Gilbert.
1937.7.22.28-30	♂♂	Darling Range, W.A.	Nicholls.
1937.7.22.31-32	♂♀	Crawley, Perth, W.A.	"
1937.7.22.33-34	♂♀	Yallingup, W.A.	"
1937.7.22.35	Hgr. ♀	Denmark, W.A.	Newton.

¹ Fletcher (1893: 233) has suggested that this example was one of a series collected in 1866 by Masters in West Australia; but it was received in London in 1862, the same year in which the Leiden Museum received the specimens labelled " King George's Sound."

1936. 10. 2. 1	juv.	Rottneest Island, W.A.	Darlington. Paratype of <i>Heleioporus insularis</i> Lov.
1937. 10. 1. 1-3	2♂♂, Hgr. ♀	Bathurst Point, Rottneest Island.	Glauert.
Mus. Leiden 2223	3 imm.	King George's Sound, W.A.	(Sydney Mus.)
" " 2224	imm.	S.W. Australia.	Preiss.

Heleioporus sudelli Lamb.

Heleioporus sudelli Lamb, 1911, *Ann. Queensland Mus.*, **10** : 26 (Type locality:—Warwick, S.E. Queensland).

Vomerine teeth in two groups between the choanae. Habitus stout. Head broader than long, snout rounded, without canthus rostralis; nostril nearer the eye than the tip of the snout; interorbital space narrower than the upper eyelid; tympanum indistinct. Fingers blunt, first and second equal; toes short, blunt, half webbed; subarticular tubercles, especially those of the fingers, well developed; a small tubercle between the first and second and second and third fingers; inner metatarsal tubercle long and low; no outer metatarsal tubercle. The hind limb being carried forwards along the body, the tip of the longest toe reaches the eye or just beyond. Upper surface of body and limbs minutely tubercular; belly smooth. Brownish or olive above marbled with darker; a dark cross-band between the eyes to the outer edge of the upper eyelid; a light vertebral line and a light blotch on the upper part of the shoulders; upper edge of lower eyelid silvery white.

Length from snout to vent: 45 mm.

DISTRIBUTION: Known only from the unique type from Warwick, S.E. Queensland.

(Possibly based on a specimen of *Limnodynastes* sp.)

LIMNODYNASTES Fitzinger.

Cystignathus (part) Duméril & Bibron, 1841, *Erpét. Gén.*, **8** : 392.

Discoglossus Gray, 1842, *Zool. Miscellany* : 56.

Limnodynastes Fitzinger, 1843, *Syst. Rept.* : 31 (Type species:—*Cystignathus peronii* Dum. & Bibr.); Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 32; Steindachner, 1867, *Reise Novara, Zool., Amph.* : 25; Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 343; *idem*, 1868, *Arch. Naturgesch.*, **34** : 256; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 258; Nieden, 1923, *Das Tierreich, Anura I* : 528; Waite, 1929, *Rep. Amph. S. Austral.* : 250; Noble, 1931, *Biol. Amph.* : 497.

Lymnodynastes (emend.) Cope, 1866, *nat. Hist. Rev.* : 113; McCoy, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 182; Alexander, 1922, *J. Linn. Soc. (Zool.)*, **36** : 462.

Waglevia Girard, 1853, *Proc. Acad. nat. Sci. Philad.*, **6** : 421 (Type species by selection:—*Cystignathus peronii* Duméril & Bibron); *idem*, 1858, *U.S. Explor. Exped., Herp.* : 42.

Platyplectrum Günther, 1863, *Ann. Mag. nat. Hist.*, (3), **11** : 27 (Type species:—*P. marmoratum*); Cope, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6** : 89, 94; Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 343; *idem*, 1868, *Arch. Naturgesch.*, **34** : 260.

Borboraetes (part) Cope, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6** : 94; *idem*, 1889, *Bull. U.S. nat. Mus.*, **34** : 312.

Opisthodon Steindachner, 1867, *Reise Novara, Zool., Amph.* : 9 (Type species:—*O. frauenfeldi*). *Heliorana* *idem*, 1867, *tom. cit.* : 32 (Type species:—*H. grayi*).

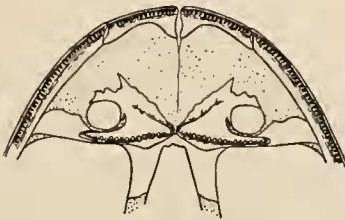
Ranaster Macleay, 1878, *Proc. Linn. Soc. N.S.W.*, **2** : 135 (Type species:—*R. convexiusculus*); Nieden, 1923, *Das Tierreich, Anura I* : 535 (part); van Kampen, 1923, *Amph. Indo-Austral. Archip.* : 19; Noble, 1931, *Biol. Amph.* : 497.

Maxillary teeth present. Prevomer present, entire, its post-choanal portion large, overlying at least the mesial half of the palatine, denticerous (text-fig. 9);

a distinct fronto-parietal foramen. Ear fully developed. Vertebrae procoelus but with the condyle incompletely ankylosed; seven presacra; sacral diapophyses slightly dilated; coccyx articulating by two condyles. Omosternum cartilaginous; sternum undivided, cartilaginous or calcified. Terminal phalanges simple. Males with a prepollex (Pl. I).

Pupil horizontal, with a downwardly directed angle ventrally. Tongue large, oval, entire and slightly free behind. Toes usually more or less webbed, not dilated distally.

TEXT-FIG. 9.



TEXT-FIG. 10.



TEXT-FIG. 11.



TEXT-FIG. 12.



TEXT-FIG. 9.—Anterior cranial elements of *Limnodynastes dorsalis dorsalis*. $\times 3$.
(From beneath.)

TEXT-FIG. 10.—Hand of *Limnodynastes tasmaniensis* ♀. $\times 4$.

TEXT-FIG. 11.—Hand of *Limnodynastes salmini* ♀. $\times 4$.

TEXT-FIG. 12.—Hand of *Limnodynastes peronii* ♀. $\times 4$.

Distal tendon of the m. semitendinosus passing ventral to, or perforating the gracilis (*ornatus*). Alary process of the hyoid narrow proximally, expanded distally; cricoid complete; oesophageal process of the cricoid slender.

This genus shows a very peculiar trend. In two species, *fletcheri* and *peronii* (text-fig. 12), and to a less extent in a third, *salmini* (text-fig. 11), the phalanges of the inner finger are greatly reduced in size, or, in some specimens, reduced to a single one, but as a compensation, so that the inner finger is still approximately as long as the second, the inner metacarpal bone is disproportionately

long. This compensation belies the possibility of the reduction being a concomitant of loss of function unless it is assumed that there has been some secondary change necessitating a re-development of an inner digit which was originally functionless and vestigial. There is no evidence to lend support to such an assumption and it is possible that an explanation is to be found by comparison with the genus *Crinia*, in which also two species (*laevis*, text-fig. 16, and *darlingtoni*) have the phalanges of the inner finger similarly reduced, though without any compensating elongation of the metacarpal. Now it may be significant that none of the species of *Limnodynastes* in which the phalanges of the inner finger are reduced in size have nuptial pads, whereas all the remaining species of the genus have them very well developed. In *Crinia laevis*, and probably *C. darlingtoni* also, nuptial pads are likewise absent. But the former species at least, and in all probability the latter too, pairs on land, whereas all the species of *Limnodynastes*, whose breeding habits are known, including *peronii* with the reduced phalanges, pair in water. It is highly probable that nuptial excrescences are not so essential to frogs pairing on land as to those where oviposition occurs in water. Reduction of the phalanges of the inner digit appears to be accompanied by loss of nuptial pads, but in the genus *Crinia*, where pairing occurs on land, this is no handicap. In the water-breeding *Limnodynastes*, however, the loss would be gravely disadvantageous and has been overcome by the enlargement of the metacarpal which can function as a nuptial spine, as it does in the Ranid genera *Petropedetes* and *Babina*. It seems possible, therefore, that the reduction of the inner finger is an orthogenetic tendency which proceeds regardless of the requirements of the animals, and that to counteract the handicap it imposes *L. fletcheri* and *L. peronii* have secondarily hypertrophied another structure to perform the same function in a different way.

SYNOPSIS OF THE SPECIES.

I. Inner metatarsal tubercle shovel-shaped.

A. A large gland on the tibia *dorsalis* subsp.

B. No tibial gland.

(1) Toes not more than $\frac{1}{4}$ webbed *ornatus*.

(2) Toes at least $\frac{1}{2}$ webbed *spenceri*.

II. Inner metatarsal tubercle not shovel-shaped.

A. Inner metacarpal equal to, or somewhat longer or shorter than, the second; the proximal phalanx of the first finger very much longer than the distal.

(1) First finger shorter than the second; usually two metatarsal tubercles; vomerine teeth not extending laterally beyond the choanae *tasmaniensis*.

(2) First and second fingers equal; a single metatarsal tubercle; vomerine teeth extending well beyond the lateral borders of the choanae *convexusculus*.

(3) First finger extending beyond the second, the proximal phalanx of the inner finger twice as long as the second; toes nearly free *salmini*.

B. Inner metacarpal very much longer than the second; phalanges of the first finger subequal, or (in *peronii*) sometimes reduced to one.

(1) Toes with a distinct basal webbing; snout not prominent . . . *fletcheri*.

(2) Toes long, slender, free; snout pointed and prominent . . . *peronii*.

***Limnodynastes dorsalis dorsalis* (Gray).**

- Cystignathus dorsalis* Gray, *Ann. Mag. nat. Hist.*, **7** : 91 (Type locality:—Western Australia); *idem*, 1841, in Grey, *Journ. Exped. W. Australia*, **2**, App. : 446; *idem*, 1845, in Eyre, *Journ. Exped. Central Austral.*, **1**, App. : pl. 1, fig. 2.
- W. (agleria) dorsalis* Girard, 1853, *Proc. Acad. nat. Sci. Philad.*, **6** : 421.
- Limnodynastes dorsalis* Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 33; Krefft, 1865, *Pap. roy. Soc. Tasmania* : 16 (part); *idem*, 1868, *Arch. Naturgesch.*, **34** : 260; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 261 (part); Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, **22**, 1897 : 675; Andersson, 1913, *K. Svenska Vetensk.Akad. Handl.*, **52**, 4 : 9, 10; Werner, 1914, *Fauna S.W. Austral.*, **4** : 406; Alexander, 1922, *J. Linn. Soc. (Zool.)*, **34** : 462; Nieden, 1923, *Das Tierreich, Anura* 1 : 532 (part); Glauert, 1929, *J. roy. Soc. W. Aust.*, **15** : 44; Noble, 1931, *Biol. Amph.* : 114.
- Limnodynastes dorsalis* var. *typica* Fry, 1913, *Rec. Aust. Mus.* **10** : 24, pl. 2, fig. 2; *idem*, 1914, *Rec. W. Aust. Mus.*, **1** : 202.
- Limnodynastes dorsalis dorsalis* (part) Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 21.

Vomerine teeth in moderately long curved series separated from the maxillae by spaces equal to, or a little greater than, half the length of a single series. Snout rounded, not prominent, 1.25 to 1.5 times as long as the eye, with rounded canthus rostralis and oblique, convex, loreal region; nostril midway between the eye and the tip of the snout; interorbital space about as broad as the upper eyelid; tympanum indistinct, its horizontal diameter about half that of the eye. Fingers moderate, the first very slightly longer than the second, the first metacarpal also being slightly longer than the second; subarticular tubercles well developed; one or two small tubercles between the first and second, and second and third fingers; a prominent inner metacarpal tubercle, with a bony prepollex and a flat, longitudinally cleft outer. Toes with a rudiment of web, variable in amount, but not more than $\frac{1}{3}$; inner metacarpal tubercle large, shovel-shaped, longer than its distance from the tip of the inner toe. Tibio-tarsal articulation reaching the tympanum or the posterior corner of the eye.

Skin smooth, feebly granular or with some flat warts above; a prominent glandular ridge from beneath the eye to the forearm and a very large, conspicuous gland occupying almost the whole upper surface of the tarsus. Smooth beneath; anal region feebly granular, with two larger glandular spots one on each side of the vent.

Pale brown or greenish above with insuliform, clearly-marked dark brown, sometimes light-edged spots in regular series; a median series down the middle of the back, commencing with a triangular one connecting the upper eyelids, is bisected by a light vertebral line which is constantly present. A dorso-lateral series runs from behind the eye to the groin. Flanks spotted and splashed with darker, the inguinal region often marbled with white (? red) and brown. A curved bar from the tip of the snout through the nostril and eye to the fore-limb; sub-aural glandular fold white or yellow. Hind limbs with dark spots on a lighter ground above; hinder side of the thighs and concealed surface of the tibiae dark brown marbled with white. Lower surfaces white, sometimes faintly dusted with darker. Throat of the male infuscate.

Male with a vocal sac opening by a slit on each side of the tongue and nuptial asperities on the metacarpo-phalangeal knuckles of the first and second fingers.

Length from snout to vent : ♂ 68 mm.

DISTRIBUTION : West Australia; Rottnest Island.

SPECIMENS EXAMINED.

B.M. 41.(2).212	♂	W. Australia.	Gould. TYPE.
41.3.6.7-8	2 ♂♂	Port Essington (?).	Fleming.
43.5.19.27	juv.	W. Australia.	[Turner.]

44.7.9.34	♂	Houtman's Abrolhos.	Gould.
95.6.21.6-7	2 ♂♂	Chapman River, W.A.	Saunders.
1931.7.1.46-48	3 juvs.	Mt. Toolbrunup, W.A.	Baldwin.
96.1.30.8	skel.	Chapman River, W.A.	Saunders.

Limnodynastes dorsalis terraereginae Fry.

Limnodynastes dorsalis Günther, 1876, *J. Mus. Godeffroy*, **12** : 47; Boulenger, 1882, *Cal. Batr. Sal. Brit. Mus.*, ed. 2 : 261 (part); Garman, 1901, *Bull. Mus. comp. Zool. Harv.*, **39** : 14; Andersson, 1916, *K. Svenska Vetensk. Akad. Handl.*, **52**, 9 : 8; Nieden, 1923, *Das Tierreich, Amura I* : 532 (part).

Limnodynastes dorsalis var. *dumerili* (non Peters) Fry, 1913, *Rec. Aust. Mus.*, **10** : 26-28, pl. 3, fig. 2.

Limnodynastes dorsalis var. *terrae-reginae* Fry, 1915, *Proc. roy. Soc. Queensland*, **27** : 67, fig. 2a (Type locality :—Somerset, Cape York).

L. dorsalis terraereginae Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 21.

This north-eastern race is similar in general morphological characters to the typical western form, except that the vomerine teeth may be slightly more extensive laterally, the first finger rather shorter (being only as long as, or but very slightly longer than, the second), shorter hind limbs, the tibio-tarsal articulation reaching the shoulder or the ear, and the sub-aural glandular fold expanded behind the angle of the mouth.

The colour is, however, very different. In juveniles there may be a pattern of spots similar to that of the typical subspecies, but the light mid-dorsal stripe is narrower and often partly or completely obliterated. With increasing size the dorsal markings break up into smaller spots and the ground-colour tends to become progressively darker, so that in adults the dorsal colour may be almost uniform dark olive; usually, however, there is some persistent trace of the spots and also there is often a light streak, with indefinite margins running forwards from the groin, obliquely upwards in the direction of the eye. Chin and throat with brown reticulations. Males with the same secondary sex-characters as in *L. dorsalis dorsalis* and females with the first and second fingers spatulate.

Length from snout to vent : ♂ 69 mm.; ♀ 76 mm.

DISTRIBUTION : Queensland as far south as the Burnett River Valley.

SPECIMENS EXAMINED.

B.M. 70.6.26.42-44,	♀, 2 Hgr., 1	Queensland.	Krefft.
49	juv.		
76.3.4.35-36	♂, ♀	Gayndah, Queensland.	Dämel.
85.9.2.30-33	4 ♂♂	Mackay, Queensland.	Ling Roth.
1903.10.19.35	♀	Near Cooktown, Queensland.	Bellenden Ker.
1924.3.3.1-2	2 juvs.	Torrens Creek, Queensland.	Wilkins.

Limnodynastes dorsalis dumerili Peters.

Limnodynastes (*Platyplectron*) *dumerili* Peters, 1863, *Mber. Akad. Berlin* : 235 (Type locality :—near Adelaide); Günther, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 54.

Platyplectron dumerili Kieferstein, 1868, *Arch. Naturgesch.*, **34** : 262.

Limnodynastes dumerili Günther, 1868, *Zool. Rec.*, 1867, **4** : 145; *idem*, 1868, *Proc. zool. Soc. Lond.* : 478.

Limnodynastes dorsalis var. *dumerili* Fry, 1913, *Rec. Aust. Mus.*, **10**, 2 : 26 (part), pl. 2, figs. 1-1a; Waite, 1929, *Rept. Amph. S. Austral.* : 252, figs. 181-183.

Limnodynastes dorsalis dumerili Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 21 (part).

Limnodynastes bibroni (nom. nud., in err. pro *dumerili*?) Krefft, 1865, *Pap. roy. Soc. Tasmania* : 16; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, Add. : 107.

L. (ymnodynastes) dorsalis McCoy, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 182.

- Limnodynastes dorsalis* McCoy, 1880, *Prodr. Zool. Victoria*, **5** : 12, pl. 42, fig. 2 ; Lucas & le Souef, 1909, *Anim. Austral.* : 271, fig. ; Nieden, 1923, *Das Tierreich, Anura I* : 532 (part).
Limnodynastes dorsalis var. *interioris* Fry, 1913, *Rec. Aust. Mus.*, **10**, 2 : 33, pl. 3, figs. 1-1c (Type locality :—Merool Creek, Riverina, N.S.W.).

As understood by Fry (1913) this race ranges from Southern Queensland southwards to South Australia and Tasmania except for a small area in western New South Wales where his *interioris* was discovered. Loveridge (1935), however, includes Tasmanian specimens under the western *dorsalis dorsalis*, but it seems highly probable that there is a distinct and recognizable race in Tasmania.

The status of Fry's *interioris*, with its strongly webbed toes and heavily pigmented lower surfaces, is uncertain, but in view of the fact that this author records specimens with these two characters from the central table-land and the mountains of New South Wales it seems possible that *interioris* ought to be united with *dumerili*. The material before the author is very scanty, but, so far as it goes, the race appears to be distinguished by a somewhat shorter snout, less than 1.25 times as long as the eye ; the first finger slightly but distinctly shorter than the second ; toes $\frac{1}{4}$, or even slightly more, webbed ; a very conspicuous wart on each side of the vent and the lower surfaces heavily marbled with brown.

DISTRIBUTION : South Australia, Victoria, southern and western New South Wales, including the mountain region.

SPECIMENS EXAMINED.

64.10.27.32-33	♂, ♀	Adelaide.	Krefft.
64.10.27.59-60	♀, Hgr.	"	"
Mus. Leiden 2033	♀	Melbourne.	van Kaathoven.

Limnodynastes dorsalis insularis subsp. n.

- Limnodynastes dorsalis* English, 1910, *Proc. zool. Soc. Lond.* : 629, pl. 51, fig. 3 ; Nieden, 1923, *Das Tierreich, Anura I* : 532 (part) ; Blanchard, 1929, *Aust. Zool.*, **5**, 4 : 326.
Limnodynastes dorsalis var. *dumerili* Fry, 1913, *Rec. Aust. Mus.*, **10**, 2 : 26 (part).
Limnodynastes dorsalis dorsalis (part) Loveridge, 1934, *Pap. roy. Soc. Tasmania*, **1933** : 58
idem, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 21.

As suggested above, the Tasmanian representative of *Limnodynastes dorsalis* may be recognizable as a distinct race. It resembles *L. dorsalis dumerili* in having the first finger slightly, but distinctly, shorter than the second and in the possession of a pair of large, prominent anal warts ; the colour, too, is essentially similar to that of specimens from New South Wales and South Australia, though the lower surfaces are only slightly brown-mottled. There is also some resemblance to *terrae-reginae* in the degree of dilatation of the sub-aural fold posteriorly. It differs from *dumerili*, however, in having a snout 1.5 to 1.7 times as long as the eye and in the toes being almost entirely devoid of webbing.

It is essentially a burrowing frog, frequenting dry country, and hibernates from mid-April until late in August. The breeding season, according to English, is from August to October, the call of the male being a very loud booming note ; Blanchard, however, found the frogs breeding in January, the eggs being laid in floating, frothy clumps, often in contact with grass or sedges.

Length from snout to vent : ♂ 58 mm. ; ♀ 57 mm.

SPECIMENS EXAMINED.

B.M. 1901.9.13.1	imm. ♂	Near Launceston.	English. (COTYPE.)
M.C.Z. Harvard 19238	♀	Eagle Hawk Neck, Tasmania.	Blanchard "
19330	♂	Tasmania.	English "

***Limnodynastes dorsalis grayi* (Steindachner).**

- Limnodynastes dorsalis* Krefft, 1865, *Pap. roy. Soc. Tasmania* : 16 (part); *idem*, 1866, *Trans. Phil. Soc. N.S.W.*, 1862-5 : 32; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.* : 107; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 374; *idem*, 1890, *op. cit.*, (2), **5** : 670-675; *idem*, 1891, *op. cit.*, (2), **6** : 271-273; *idem*, 1892, *op. cit.*, (2), **7** : 7, 8, 13; *idem*, 1894, *op. cit.*, (2), **8** : 526, 528, 530; Harrison, 1922, *Aust. Zool.*, **3**, **1** : 33; Nieden, 1923, *Das Tierreich, Anura I* : 532 (part), figs. 362, 363.
- Heliorana grayi* Steindachner, 1867, *Reise Novara, Zool., Amph.* : 32, pl. 2, figs. 11-14 (Type locality :—New South Wales); Keferstein, 1868, *Arch. Naturgesch.*, **34** : 266.
- Platyplectrum superciliare* Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 346 (Type locality :—Australia).
- Heliorana superciliaris* Keferstein, 1868, *Arch. Naturgesch.*, **34** : 267, pl. 5, fig. 7.
- Limnodynastes dorsalis* var. *dumerili* Fry, 1913, *Rec. Aust. Mus.*, **10**, **2** : 26 (part).
- Limnodynastes dorsalis dumerili* Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 21 (part).

Fry (1913 : 29), in his consideration of the races of *Limnodynastes dorsalis*, has pointed out that *dumerili* shows a great amount of local variation. If geographical races are to be recognized at all it seems certain that *dumerili*, *sensu* Fry, must be subdivided, and one of its constituents is the small coastal form of New South Wales, for which the name *Heliorana grayi* seems to be available.

This race is generally similar to the typical form, but is distinguished by its smaller size (it rarely exceeds 55 mm. in length), subequal first and second fingers, a pair of prominent warts on either side of the vent, and the subaural glandular fold strongly dilated posteriorly.

The coloration is similar to that of the northern *terrae-reginae* except that the hinder sides of the thighs are brown, regularly dotted with white or red. Lower surfaces white or faintly brown dusted.

DISTRIBUTION : New South Wales east of the dividing range ; ? South-eastern Queensland.

Breeding period probably extensive ; spawn in a mass of frothy jelly ; tadpoles very large, 2.5-3 in. in length ; young at metamorphosis 21 mm. (Fletcher).

SPECIMENS EXAMINED.

B.M. 88.7.3.11	♂	Sydney.	Fletcher.
1925.5.25.1	♀	Nowra, N.S.W.	Rodway.
1929.7.9.1-7	7 juvs.	" "	"

***Limnodynastes ornatus* (Gray).**

- Discoglossus ornatus* Gray, 1842, *Zool. Miscellany* : 56 (Type locality :—Port Essington); *idem*, 1845, in Eyre, *Journ. Exped. C. Austral.* **II** : pl. 2, fig. 2.
- Perialia* ? *ornata idem*, 1845, *tom. cit.* : 407.
- Limnodynastes ornatus* Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 33; Krefft, 1865, *Pap. Proc. roy. Soc. Tasmania* : 17; Günther, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 54; *idem*, 1868, *Zool. Rec.*, **4** : 145; *idem*, 1876, *Mus. Godeffroy*, **12** : 47; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 262; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 386; *idem*, 1890, *op. cit.*, (2), **5** : 672; *idem*, 1894, *op. cit.*, (2), **8** : 524, 529, 530; Boettger, 1894, *Denkschr. med.-naturw. Ges. Jena*, **8** : 109, 110; Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, **22**, 1897 : 676; Lucas & le Souef, 1909, *Anim. Austral.* : 273, fig.; Andersson, 1913, *K. Svenska Vetensk. Akad. Handl.*, **52**, **4** : 9, 11; Fry, 1914, *Rec. W. Austr. Mus.*, **1** : 202; Andersson, 1916, *K. Svenska Vetensk. Akad. Handl.*, **52**, **9** : 8; Nieden, 1923, *Das Tierreich, Anura I* : 533 (part); Kinghorn, 1931, *Rec. Aust. Mus.*, **18**, **3** : 89; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 22.
- Platyplectrum ornatum* Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 346; *idem*, 1868, *Arch. Naturgesch.*, **34** : 261.
- Platyplectrum marmoratum* Günther, 1863, *Ann. Mag. nat. Hist.*, (3), **11** : 27, pl. 4, fig. A

(Type locality :—Clarence River, N.S.W.); Krefft, 1865, *Pap. Proc. roy. Soc. Tasmania* : 17; *idem*, 1867, *Cal. Industr. Prod. N.S.W., Add.* : 107; Kieferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 345; *idem*, 1868, *Arch. Naturgesch.*, **34** : 261; Günther, 1868, *Proc. zool. Soc. Lond.* : 480.

♂ *Platyplectrum occidentale* Cope, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6** : 90 (Type locality :—West Australia).

Opisthodon frauenfeldi Steindachner, 1867, *Reise Novara, Zool., Amph.* : 9, pl. 1, figs. 1-4 (Type locality :—New South Wales).

O. frauenfeldi Cope, 1867, *J. Acad. nat. Sci. Philad.* (2), **6** : 201.

Vomerine teeth in transverse, slightly curved series behind the choanae, separated from the maxillae by a space equal to about the length of one series. Snout short, rounded, not prominent, as long as, or very slightly longer than the eye; canthus rostralis rounded, loreal region moderately oblique; nostrils directed upwards, halfway between the tip of the snout and the eyes or slightly nearer the latter; interorbital space less than the width of an upper eyelid; tympanum very indistinct, $\frac{1}{3}$ to $\frac{2}{3}$ the diameter of the eye. Fingers short, not depressed, the first being either slightly longer or shorter than the second; subarticular tubercles well developed and prominent; a small supernumerary tubercle proximal to the basal subarticular of each finger and some fleshy web which may be tubercular between the first and second and second and third fingers; a prominent inner metacarpal tubercle, with a bony prepollex in males, and a longitudinally cleft outer, of which the outermost portion may be very indistinct or absent. Toes slender, with distinct basal webbing which frequently, in adults, extends along the toes as a distinct fringe; in juveniles and immature specimens the web midway between the third and fourth toes does not extend as far as the proximal subarticular tubercle of the fourth toe, but in adults it usually reaches to this level or very slightly beyond it; subarticular tubercles prominent; a large, shovel-shaped inner, but no outer, metatarsal tubercle. Tibio-tarsal articulation reaching the ear or the eye.

Skin usually with small, not very prominent, warts which may form longitudinal series on the back and on the upper eyelids; some tubercles at the corner of the mouth. Lower surfaces smooth; anal region granular.

Colour very variable; usually pale brown or grey above with numerous irregular darker markings, of which the most constant are :—a curved streak from the end of the snout, through the nostril, along the canthus rostralis, through the eye and expanding over the tympanic region; a vertical dark bar below the anterior half of the eye; an interorbital bar interrupted in the middle; an X- or H-shaped figure on the anterior part of the back, of which the anterior extremities arise from the posterior corners of the eyes. Frequently the area between the interorbital bar and the anterior portion of the X or H is uniformly light in colour, and one well-marked colour variant is uniformly brown or grey over the whole of the upper surface of the body, the cantho-temporal streak and labial markings alone persisting. Usually the whole of the dorsum is covered with sinuous dark markings which often have less-dark lines running close to and parallel with their outlines. Limbs with alternately broader and narrower dark cross-bars. Lower surfaces uniform white except the sides of the throat which are freckled with darker. Concealed surfaces of the hind limbs dark brown, uniform or stippled with white.

Length from snout to vent : ♂ 41 mm.; ♀ 42 mm.

Male with a vocal sac opening by a slit on each side of the tongue and with 3 patches of nuptial asperities, one on the dorso-lateral surface of the inner metacarpal tubercle, one on the dorsal and lateral surfaces of the first finger and the

other similarly disposed on the second finger. Fingers of the female not depressed or fringed.

DISTRIBUTION: West Australia, Northern Territories, Groote Eylandt, Queensland, Thursday Island and northern New South Wales.

SPECIMENS EXAMINED.

63.6.16.96	♂	Clarence River, N.S.W.	Krefft. Type of <i>Platyplectrum marmoratum</i> .
88.7.3.12	juv.	Guntawang, N.S.W.	Hamilton.
1926.2.25.7	♀	40 miles S. of Moree, N.S.W.	Wilkins.
67.5.6.89-91	♂♀	Port Denison, Queensland.	Dämel.
64.10.27.49-51	2 ♂♂, ♀	" "	Krefft.
76.3.4.38-39	2 ♀♀	Peak Downs, "	(Godeffroy Mus.)
67.5.6.87-8	2 ♀♀, juv.	Cape York, "	Dämel.
67.5.13.29		" "	"
85.9.2.26-29	♂, 3 ♀♀	Mackay, "	Ling Roth.
1924.3.3.4	♀	Torrens Creek, "	Wilkins.
1926.2.25.6	♀	" "	"
1924.10.25.3	juv.	Westwood, "	"
1930.10.11.2	♂	Stewart River, "	Thomson.
57.10.24.50	♂	" North Australia."	Elsey.
1906.3.31.20	♀	Alexandria Sta.	Stalker.
		137° E. 19° S.	
1906.11.2.7	imm. ♀	Alexandria Sta.	"
1926.2.25.5	♂	Groote Eylandt.	Wilkins.
42.2.24.17	♂	Port Essington.	Gilbert. TYPE.
85.9.2.18-19	♂♀	Albany, W. Australia.	Ling Roth.
Mus. Leiden 3930	juv.	Rockhampton, Queensland.	(Godeffroy Mus.)
" " 3820	"	" "	" "

Limnodynastes spenceri sp. n.

Limnodynastes ornatus (non Gray) Spencer, 1896, *Rep. Horn Exped. C. Austral.*, II, Zool.: 156, pl. 13, figs. 3, 4; pl. 15, figs. 18-25; Spencer & Gillen, 1912, *Across Australia*, I: 58, pl. 1, fig. b; Harrison, 1922, *Aust. Zool.*, 3, 1: 34; Nieten, 1923, *Das Tierreich*, *Amura* I: 533 (part), figs. 364-367; Waite, 1929, *Rept. and Amph. S. Australia*: 256; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 22 (part).

Limnodynastes sp. Loveridge, 1938, *Trans. roy. Soc. S. Aust.*, 62, 2: 189.

Holotype a male, number 97.10.27.69 in the British Museum, collected at Alice Springs, C. Australia, by Professor W. B. Spencer.

Vomerine teeth in rather short curved series, widely separated from the maxillae. Snout almost vertically truncate, short, as long as the eye, with rounded canthus rostralis and slightly oblique loreal region; nostrils directed vertically upwards midway between the tip of the snout and the eye; inter-orbital space a little less than the width of the upper eyelid; tympanum hidden. Fingers short, the first and second depressed; first a little longer than the second; subarticular tubercles large and prominent; a distinct supernumerary tubercle at the base of all except the outer fingers, and traces of other tubercles along the metacarpals; one or two distinct, conical tubercles between the first and second and second and third fingers; a prominent inner metacarpal tubercle, with a bony prepollex, and a rather flat outer. Toes pointed and webbed to the tips, the lowest point of the web between the third and fourth toes reaching well

beyond the level of the distal subarticular tubercle of the third toe ; subarticular tubercles small but distinct, the basal one (metatarso-phalangeal articulation) of the fourth toe wanting ; a very large, shovel-shaped inner metatarsal tubercle. Tibio-tarsal articulation reaching the tympanic region.

Skin smooth above and below ; anal region granular ; a few indistinct warts on the upper eyelid.

Pale brownish grey above with irregular dark markings ; a chevron-shaped cross-bar connecting the upper eyelids and a dark stripe from the posterior corner of each eyelid, curving towards, but not meeting its fellow on the scapular region ; remainder of the dorsum with irregularly-shaped dark blotches and spots ; a dark streak from the labial margin through the nostril and along the canthus rostralis and a vertical bar running somewhat obliquely forwards from beneath the eye. Lower surfaces uniform white. Limbs with dark cross-bars.

A vocal sac opening by a slit on each side of the tongue. Four distinct dark brown patches of nuptial asperities on each hand, one on the lateral aspect of the inner metacarpal tubercle, another covering the dorsal surface of the inner finger (except for the terminal joint) a third on the dorso-lateral aspect of the second finger and the fourth along the inner edge of the third finger. The whole of the dorsum is more or less beset with minute dark, horny spinules.

Length from snout to vent : 39 mm.

The paratypes agree closely with the type in almost all morphological characters. The principal variation is to be found in the degree of webbing of the toes. Spencer has stated that the amount of webbing is independent of sex and age and that it overlaps that described for *ornatus*. But in this he seems to be wrong, for no specimen from Central Australia has as little web as *ornatus*, in which this character shows very little variation over a wide area (p. 49). In these Central Australian frogs (which differ also from *ornatus* in their somewhat shorter truncate snouts, shorter hind limbs, absence of the proximal tubercle of the fourth toe, and the presence of a nuptial pad on the third finger) the minimum amount of webbing is in females and immature examples ; but even here the lowest point of the web between the third and fourth toes reaches almost or quite to the distal subarticular tubercle of the third toe, whereas in *ornatus* it never extends beyond half way between the proximal and distal tubercles. In adult males the lowest point is always beyond the distal tubercle of the third toe.

Length from snout to vent : ♂ 44 mm. ; ♀ 49 mm.

DISTRIBUTION : Apparently confined to the central, desert regions of the Northern Territories and South Australia from Oodnadatta to the Macdonnell Range west to Hermannsburg and Officer Creek.

The species frequents soft, sandy ground, generally in the beds of creeks ; it burrows by day to a depth of about a foot and becomes active by night. Spawning takes place in the early part of the year (January or February) in waterholes. The tadpole reaches a length of 56 mm., the body 25 mm. and the tail 31, the latter being 11 mm. deep and rounded terminally with subequal ventral and dorsal crests. Body once and a half to nearly twice as long as broad ; nostrils directed upwards, nearer a line connecting the anterior borders of the eyes than the end of the snout ; spiraculum sinistral ; anus dextral. Mouth surrounded by a fringe of papillae except its median half anteriorly ; the papillae forming a single row except at the corners of the mouth where they invade the oral cavity. Mandibles very finely denticulate ; two long rows of labial teeth anteriorly, the inner divided mesially ; three long rows posteriorly, the innermost divided, the outermost shortest. Toes webbed as in adult females.

SPECIMENS EXAMINED.

B.M.	97.10.27.68	♂	Alice Springs, N.T. Australia.	Spencer.	TYPE.
	97.10.27.60-67	8 ♂♂, 2 ♀♀	" "	"	} Para- types.
	1910.5.28.32-35	3 ♂♂, ♀	Hermannsburg,	Hillier.	
	1932.3.7.1-2	2 juvs.	Central Australia.	Basedow.	
M.C.Z.	18530-18546	9 ♂♂, 11 ♀♀	Hermannsburg, N.T.	Schevill.	
		5 juvs.			
B.M.	97.10.27.69	skel.	Alice Springs, N.T.	Spencer.	
	1907.10.3.2	Larva.	Hermannsburg.	Hillier.	

***Limnodynastes tasmaniensis* Günther.**

Limnodynastes tasmaniensis Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 33, 134, pl. 2, fig. B (Type localities:—Tasmania and New Holland); Peters, 1863, *Mber. Akad. Berlin*: 235; Krefft, 1865, *Pap. Proc. R. Soc. Tasmania*: 16; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.*: 107; Steindachner, 1867, *Reise Novara, Zool., Amph.*: 26; Keferstein, 1868, *Arch. Naturgesch.*, **34**: 258; McCoy, 1880, *Prodrom. Zool. Victoria*, **5**: 11, pl. 42, fig. 1; Parker, 1881, *Phil. Trans. roy. Soc. Lond.*, **3**: 99, pl. 18, figs. 5-8; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 260; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4**: 374; *idem*, 1890, *op. cit.*, (2), **5**: 669-675; *idem*, 1891, *op. cit.*, (2), **6**: 271, 272, 274; *idem*, 1892, *op. cit.*, (2), **7**: 7; *idem*, 1894, *op. cit.*, (2), **8**: 527, 528, 530; Lucas & le Souef, 1909, *Anim. Austral.*: 269, figs. ; English, 1910, *Proc. zool. Soc. Lond.*: 628, pl. 51, figs. 1, 2; Fry, 1915, *Proc. R. Soc. Queensland*, **27**, 4: 62; Harrison, 1922, *Aust. Zool.*, **3**, 1: 33; Nieden, 1923, *Das Tierreich, Amura* 1: 531; Waite, 1929, *Rept. Amph. S. Austral.*: 251, figs. 179, 180; Kinghorn, 1932, *Rec. Aust. Mus.*, **18**: 361; Loveridge, 1934, *Pap. roy. Soc. Tasmania*, 1933: 59; *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 19 (part).

Limnodynastes tasmanicus McCoy, 1867, *Ann. Mag. nat. Hist.*, (3), **20**: 182.

Limnodynastes peronii var. *tasmaniensis* Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18**: 344.

Limnodynastes peronii (part) Fitzinger, 1861, *S.B. Akad. wiss. Wien*, **42**: 414.

Limnodynastes affinis Günther, 1863, *Ann. Mag. nat. Hist.*, (3), **11**: 27 (Type locality:—Clarence River, N.S.W.); Krefft, 1865, *Pap. roy. Soc. Tasmania*: 16; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.*: 107; McCoy, 1867, *Ann. Mag. nat. Hist.*, (3), **20**: 182; Günther, 1868, *Proc. zool. Soc. Lond.*: 480.

Limnodynastes peronii var. *rugulosus* Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18**: 344 (Type locality:—Sydney).

Limnodynastes platycephalus Günther, 1867, *Ann. Mag. nat. Hist.*, (3), **20**: 54 (Type locality:—Adelaide); *idem*, 1868, *Proc. zool. Soc. Lond.*: 480; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 260, pl. 17, fig. 3; Fry, 1915, *Proc. roy. Soc. Queensland*, **27**, 4: 63; Nieden, 1923, *Das Tierreich, Amura* 1: 532; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 19.

Limnodynastes tasmaniensis var. *platycephalus* Waite, 1929, *Amph. S. Australia*: 250.

Vomerine teeth in nearly straight transverse series, almost in contact mesially but separated from the maxillae laterally by a space nearly equal to the length of one series. Snout rounded, slightly prominent, 1.3 to 1.5 times as long as the eye, with rounded canthus rostralis and oblique loreal region; nostril midway between the tip of the snout and the eye or very slightly nearer the latter; inter-orbital space equal to, or slightly wider than, the width of the upper eyelid; tympanum indistinct, about half the length of the eye. Fingers moderate, the first distinctly shorter than the second, and with a shorter metacarpal than the second; subarticular tubercles moderate; a prominent, inner, metacarpal tubercle, with a bony prepollex in males, and a flat, longitudinally cleft, outer; fingers all with lateral "seams." Toes with a slight indication of web at the base and with lateral "seams" which rarely are developed to form well-developed dermal fringes; subarticular tubercles moderate; a prominent oval inner, and usually a very small outer, metatarsal tubercle. Tibio-tarsal articulation reaching the posterior corner of the eye in juveniles and males, the tympanic region in females.

Skin smooth or very slightly warty above; smooth beneath; a narrow, pronounced glandular fold from beneath the eye, beneath the tympanum to the insertion of the fore limb. Hinder side of the thighs below the vent slightly granular.

Light brown, yellowish or infused with pink above, usually with regular, large, dark brown or green spots, of which the most constant is a triangular, interorbital marking. The number, disposition and size of the spots is variable and they may be very indistinct. There is constantly a curved, dark brown stripe from the tip of the snout along the canthus rostralis, through the eye and tympanum to the fore-limb, above the sub-aural glandular fold, which is yellow, and frequently a yellow, orange or reddish vertebral stripe from the tip of the snout to the vent. Limbs with dark cross-bars. Lower surfaces uniform white except the gular region of the male, which is uniformly dusky.

Male with a vocal sac opening by a slit on each side of the tongue and brown nuptial asperities at the breeding season on the inner metacarpal tubercle, adjacent parts of the inner digit and metacarpo-phalangeal knuckle of the second finger. Breeding females with the first and second fingers strongly depressed and spatulate, with thick fleshy fringes more strongly developed on their pre-axial margins.

Length from snout to vent : ♂ 39 mm.; ♀ 42 mm.

DISTRIBUTION : Tasmania, Victoria, S. Australia, New South Wales and southern Queensland.

The species frequents relatively dry areas and breeds throughout the year, usually after rain. The call of the species is given in two keys, a lower "cook-kuk-kuk-cook" and a higher (? female) "Kuk-ku-kuk." Amplexus is axillary and spawning takes place in any available water-supply, though in captivity the presence of plants in the water appears to have a stimulating effect. The eggs are small, about 1.3 mm. in diameter, and are enclosed in a floating gelatinous mass which contains many air-bubbles. This foam "nest" is produced by the female paddling with her fore-limbs at the surface of the water before and during the act of oviposition. This action, rendered more efficient by the dilated fingers of this sex, causes a stream of bubbles to pass backwards under the bodies of the frogs; these accumulate in the cloacal region, where they become entangled in the mucus which precedes and accompanies the extrusion of the eggs. The egg mass, measuring *circa* 60 × 35 mm., contains about 200 to 300 eggs which, at a temperature of 22° C., hatch in 48 hours; the newly emerged larvae measure from 2.5 to 5 mm. and immediately attach themselves to water plants, debris, etc. Growth under favourable conditions is rapid; the larval stage may be prolonged to 4 or 5 months and the mature tadpole measures about 60 mm., though lungs are developed and functional 5 days after hatching; the juvenile frog at metamorphosis measures 15 mm. Sexual maturity is reached (in captivity) in the following year, 7 months after metamorphosis.

Numerous observations, often contradictory, on the behaviour and breeding habits of the species have been published, notably in the *Blätter für Aquarien-und Terrarienkunde*. The following references may be cited: Zernecke, 1926, 37: 465; Rehacek, *tom. cit.*: 120; Wolterstorff, *tom. cit.*: 463; Schreitmüller, 1927, 38: 104; Weingand, 1928, 39: 30; Geyer, *tom. cit.*: 195, 224; Hesse, 1932, 43: 315; Luther, 1933, 44: 362.

I have been unable to find any characters whereby *platycephalus* may be distinguished from *tasmaniensis*, and in view of this and the fact that Loveridge (1935: 20) refers two frogs from Kangaroo Island, S. Australia, one to *tasmaniensis* and one to *platycephalus*, it seems probable that they cannot be retained

as distinct species. *Limnodynastes olivaceus* de Vis, on the other hand, appears to represent a distinct northern species and is not, as Loveridge (*op. cit.*) believes, a synonym of *tasmaniensis*. A few specimens of *tasmaniensis* in which the outer metatarsal tubercle is wanting approach the condition of *olivaceus* (*q.v.*), but the two may be distinguished by their inner fingers, vomerine teeth, subarticular tubercles and gular coloration.

SPECIMENS EXAMINED.

B.M.	45.5.2.34-36	3 ♀♀	Tasmania.	Gunn. COTYPES.
	58.11.25.75-78	2 ♂♂, Hgr. and juv.	" Van Diemen's Land."	Smith.
	1901.9.13.2-7	♂, 4 ♀♀, juv.	Near Launceston.	English.
	1936.9.7.1-3	2 ♂♂, ♀	" "	"
	74.4.29.1243-1249	2 ♂♂, 7 ♀♀	Sandhurst, Victoria.	Beddome.
	74.4.29.1284-5			
	64.10.27.54-55	2 ♂♂	Adelaide.	Krefft. (Cotypes of <i>Limnodynastes platycephalus</i> Günther.)
	46.7.11.67-68	2 ♂♂	" New Holland."	Jukes. COTYPES.
	44.10.17.20	♀, juv.	" "	(Lord Derby.) COTYPES.
	63.6.16.86	♀	Clarence River, N.S.W.	Krefft. (Type of <i>L. affinis</i> Günther.)
	88.7.3.9-10	♂, 2 ♀♀, Hgr., juv.	Capetree, N.S.W.	Fletcher.
	92.9.16.2	♀	Sydney.	"
	96.7.1.31	♀	Tamworth, N.S.W.	Porter.
	1926.2.25.8-11	♂, 2 ♀♀, juv.	40 miles S. of Moree, N.S.W.	Wilkins.
	70.6.26.45.53.54	2 ♀♀, juv.	Queensland.	Krefft.
	67.5.6.82	♂	Rockhampton, Q.	Dämel.
	98.10.19.18-19	♂♀	Cooktown, Q.	Le Souef.
	1901.9.13.9	Skel. ♀	Near Launceston, Tasmania.	English.
Mus. Leiden	6786	♀	Port Mackay, Q.	(Godeffroy Mus.)
" "	4252	♂	Queensland.	(" ")
" "	4258	♂	"	(" ")

Limnodynastes convexiusculus (Macleay).

Ranaster convexiusculus Macleay, 1828, *Proc. Linn. Soc. N.S.W.*, 2: 135 (Type locality:—Katow, Brit. N. Guinea); Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 444; Barbour, 1912, *Mem. Mus. Comp. Zool. Harvard*, 44, 1: 177; Fry, 1913, *Mem. Queensland Mus.*, 2: 47; Nieden, 1923, *Das Tierreich, Anura I*: 537, figs. 369, 370; van Kampen, 1923, *Amph. Indo-Austr. Archip.*: 19, fig. 3.

Limnodynastes olivaceus de Vis, 1884, *Proc. Linn. Soc. N.S.W.*, 9: 66 (Type locality:—Mackay, Queensland); Boulenger, 1885, *Ann. Mag. nat. Hist.*, (5), 16: 387; Fry, 1913, *Proc. roy. Soc. Queensland*, 27: 65; Nieden, 1923, *tom. cit.*: 530.

Phanerotis novae-guineae van Kampen, 1909, *Nova Guinea*, 9, 1: 36, pl. ii, fig. 4 (Type locality:—Merauke, Dutch N. Guinea).

Limnodynastes salmini (part) Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 19.

Vomerine teeth in very long, slightly curved series, almost in contact mesially, and separated from the maxillae by a space much less than half the length of one series. Snout pointed, scarcely prominent, 1.5 to 1.8 times as long as the eye, with rounded canthus rostralis and very oblique loreal region; nostril midway between the tip of the snout and the eye or a little nearer the latter; interorbital space equal to, or a little broader than the upper eyelid; tympanum indistinct, about half the diameter of the eye. Fingers moderate, rounded, without lateral seams; first finger equal to the second; first metacarpal as long as the second; a very prominent inner metacarpal tubercle, with a bony prepollex

in males, and a flat outer, fissured longitudinally; subarticular tubercles very large and prominent; sometimes a supernumerary tubercle on the base of each finger proximal to the basal tubercle and indications of a tubercle between the first and second fingers. Toes cylindrical, without fringes or lateral seams, with the merest indication of web at the base; subarticular tubercles large and prominent; a prominent, oval, inner, but no outer, metatarsal tubercle. Tibio-tarsal articulation reaching the posterior corner of the eye.

Skin with numerous glandular areas above, which may be raised to form distinct plicae (often as a post-mortem condition when immersed in too concentrated a preservative); a glandular fold from beneath the eye to the fore-limb; lower surfaces smooth; anal region granular.

Grey or brown above, with numerous insuliform spots irregularly arranged in linear series; the most constant are a quadrangular pair closely apposed commencing one on each upper eyelid and running backwards on to the scapular region; a dark blotch commencing on the tip of the snout, running through the eye and covering the tympanic region; a dark labial spot below the eye; subaural glandular fold white. Limbs with irregular dark cross-bars; hinder side of the thighs brown, mottled and spotted with white. Lower surfaces white, the gular region with brown or grey reticulations.

Male with a vocal sac opening by a slit on each side of the tongue and a nuptial rugosity on the metacarpo-phalangeal knuckle of the first finger. Female without or with only slightly spatulate fingers.

Length from snout to vent: ♂ 44 mm.; ♀ 51 mm.

DISTRIBUTION: New Guinea, Queensland and Northern Territories.

This species is very closely allied to *tasmaniensis* and to *salmini*, but may be distinguished from either by the characters given in the synopsis. Loveridge, misled by de Vis' original statement that there are two metatarsal tubercles, concluded that Fry's redescription (1915: 65) was based on a different frog and placed *olivaceus* as a synonym of *tasmaniensis*. But the type and other material examined reveals constancy in the presence of only a single metatarsal tubercle and the presumption is that Fry was correct.

SPECIMENS EXAMINED.

B.M. 85.9.2.25	♀	Mackay, Queensland.	Ling Roth. Type of <i>Limnodynastes olivaceus</i> de Vis.
92.1.14.17	♀	Port Darwin, N.T.	Walker.
95.11.14.23	♀	Daly River, N.T.	Dahl.
1926.2.25.3-4	♂♀	Groote Eylandt.	Wilkins.
Mus. Amsterdam	♂	Fred Hendrik Island, New Guinea.	Maart.
" "	♂	Merauke, New Guinea.	Koch. (Cotype of <i>Phanerotis novae guineae</i> van Kampen.)
" "	♀	" "	v. Weel.

Limnodynastes salmini Steindachner.

Limnodynastes salmini Steindachner, 1867, *Reise Novara, Zool., Amph.*: 27, pl. 4, figs. 12-15 (Type locality:—Australia); Kieferstein, 1868, *Arch. Naturgesch.*, 34: 259; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 259; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), 4: 374; *idem*, 1890, *op. cit.*, (2), 5: 669-675; *idem*, 1891, *op. cit.*, (2), 6: 265, 272; *idem*, 1894, *op. cit.*, (2), 8: 530; Boettger, 1894, *Denkschr. med.-naturw. Ges. Jena*, 8: 109; Nieden, 1923, *Das Tierreich, Anura I*: 530; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 19.

Limnodynastes krefftii (non Günther, 1863) Günther, 1867, *Ann. Mag. nat. Hist.*, (3), 20: 54.

Vomerine teeth in long, slightly curved series, almost in contact mesially and separated from the maxillae laterally by a space much less than half the length of one series. Snout bluntly rounded, not prominent, about once and a half as long as the eye, with rounded canthus rostralis and very oblique loreal region; nostril midway between the tip of the snout and the eye or a little nearer the latter; interorbital space subequal to the width of the upper eyelid; tympanum more or less distinct, $\frac{1}{2}$ to $\frac{3}{5}$ the diameter of the eye. Fingers moderate, rounded, without lateral "seams"; first metacarpal distinctly longer than the second; first finger extending beyond the second, the proximal phalanx very much longer than the distal; a prominent inner metacarpal tubercle, with a bony prepollex in males, and a flat outer, fissured longitudinally; subarticular tubercles very large and prominent; a supernumerary tubercle at the base of each finger and a distinct tubercle between the first and second fingers.

Toes cylindrical, without seams or fringes, with the merest trace of web at the base; subarticular tubercles large and prominent; a prominent, elongate inner, but no outer, metatarsal tubercle. Tibio-tarsal articulation reaching the tympanum in adults, the posterior corner of the eye in juveniles.

Skin smooth or with some scattered flat warts above; smooth beneath; a strong glandular ridge from beneath the eye to the insertion of the fore-limb; sometimes a strong pectoral fold; anal region feebly granular.

Brown or pinkish above with small, scattered, subcircular dark spots; an irregular dark blotch from the nostril, along the canthus rostralis, through the eye and covering the tympanic region above the subaural glandular fold, which is yellow or red; a dark labial spot below the anterior half of the eye; a red or pink line runs from above the shoulder obliquely to the groin and there may be traces of a similarly coloured vertebral stripe, especially in the coccygeal region. Groins and concealed surfaces of the hind limbs dark brown with small yellow or white spots. Lower surfaces dirty white; gular region more or less heavily dusted with brown.

Male with a vocal sac opening by a slit on each side of the tongue. First and second fingers of the female with a fleshy fringe on their preaxial sides.

Length from snout to vent: ♂ 63 mm.; ♀ 70 mm.

DISTRIBUTION: New South Wales both east and west of the dividing range as far south as Sydney (Castlereagh); E. Queensland.

This species, which is so closely allied to *olivaceus* that the two have probably been confused, is recognizable by its larger size, longer first finger and metacarpal, somewhat shorter legs and colour.

SPECIMENS EXAMINED.

B.M. 62.8.1.28	imm. ♀	Sydney.	(Stevens.)
64.10.9.7	♀	Clarence River, N.S.W.	Kreff.
64.10.27.45	juv.	" "	"
67.5.6.83	juv.	Port Denison, Q.	Dämel.
67.5.13.26-27	♂, ♀	Rockhampton, Q.	"
Mus. Leiden 1733	♀, juv.	Port Mackay, Q.	(Godeffroy Mus.)

Limnodynastes fletcheri Boulenger.

Limnodynastes fletcheri Boulenger, 1888, *Ann. Mag. nat. Hist.*, (6), 2: 142 (Type locality:—Guntawang, near Mudgee, N.S.W.); Fletcher, 1890, *Proc. Linn. Soc. N.S.W.*, (2), 5: 672, 675; *idem*, 1894, *op. cit.*, (2), 8: 529; Fry, 1915, *Proc. R. Soc. Queensland*, 27, 4: 65; Nieten, 1923, *Das Tierreich, Amura* 1: 531.

Limnodynastes tasmaniensis (part) Fletcher, 1892, *Proc. Linn. Soc. N.S.W.*, (2), 7: 8, 9, 16; *idem*, 1894, *op. cit.*, (2), 8: 529.

Limnodynastes marmoratus Lamb, 1911, *Ann. Queensland Mus.*, 10: 28 (Type locality:—Goondiwindi); Fry, 1912, *Rec. Aust. Mus.*, 9: 98, 106.

Vomerine teeth in relatively short transverse series, separated from the maxillae by spaces about equal to the length of one series of teeth. Snout depressed, rounded, 1.3 to 1.5 times as long as the eye, with very obtuse canthus rostralis and oblique loreal region; nostril midway between the tip of the snout and the eye; interorbital space a little less, or a little greater, than the width of the upper eyelid; tympanum indistinct, about half the diameter of the eye. Fingers depressed, with lateral "seams"; first not extending quite as far as the second, the proximal and distal phalanges small, subequal, but the first metacarpal greatly elongate, much longer than the second; subarticular tubercles distinct but not prominent; no supernumerary tubercles and no tubercles between the fingers. A prominent inner metacarpal tubercle, with bony prepollex in males, and a small longitudinally cleft outer. Toes pointed, with lateral seams and some webbing; in males the web midway between the third and fourth toes extends distally beyond the proximal tubercle of the fourth toe; in females to about the centre of this tubercle; an oval inner, but no outer, metatarsal tubercle.¹ Tibio-tarsal articulation reaching the tympanum or the posterior corner of the eye.

Skin smooth or somewhat warty and glandular above; smooth beneath; anal region feebly granular; a glandular ridge from beneath the eye to the insertion of the fore-limb.

Pale brown or grey above, with darker brown or grey spots and suffused with carmine or pink, especially on the upper eyelids. The most constant markings are a labial spot beneath the eye, a curved band along the canthus rostralis and from the eye to the fore-limb, an interorbital blotch and a subquadrangular mark (very irregular) from the scapular region almost to the sacrum. Sub-aural fold lighter; limbs with dark spots and cross-bars above, the concealed surfaces pale, mottled and stippled with darker. Lower surfaces uniformly white, except that the edge of the lower jaw and the gular region may be very feebly stippled with darker.

Male with a vocal sac opening by a slit on each side of the tongue; first finger swollen but apparently without a spinose nuptial pad. Second finger of the female somewhat spatulate.

Length from snout to vent: ♂ 47 mm.; ♀ 41 mm.

DISTRIBUTION: New South Wales west of the dividing range, and southern Queensland; probably extending into northern Victoria and South Australia.

SPECIMENS EXAMINED.

B.M. 88.7.3.7-8	2 ♂♂	Guntawang, N.S.W.	Hamilton. TYPES.
92.9.16.3	♂	Wentworth, N.S.W.	Oliff.
1926.2.25.12	♂	40 miles S. of Moree, N.S.W.	Wilkins.
92.9.16.4	♀	Waroo, S. Queensland.	Ewen.
1923.11.12.2	Hgr.	St. George Distr., S. Queensland.	Wilkins.

Limnodynastes peronii (Dum. & Bibr.).

Cystignathus peronii Duméril & Bibron, 1841, *Erpét. Gén.*, 8: 409 (Type locality:—New Holland). *Limnodynastes peronii* Fitzinger, 1843, *Syst. Rept.*: 31; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 134; Fitzinger, 1861, *S.B. Akad. wiss. Wien*, 42: 414 (part); Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, 18: 343; *idem*, 1868, *Arch. Naturgesch.*, 34: 257, pl. 5, fig. 1; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 258; *idem*, 1885,

¹ The original description of an outer tubercle as present appears to be erroneous.

² Originally, but erroneously, described as ♂ and ♀.

- Ann. Mag. nat. Hist.*, (5), **16** : 386; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2) **4** : 373; *idem*, 1890, *op. cit.*, (2), **5** : 669-673; *idem*, 1891, *op. cit.*, (2), **6** : 272; *idem*, 1892, *op. cit.*, (2), **7** : 8-13; *idem*, 1894, *op. cit.*, (2), **8** : 524, 526, 527, 529; Lucas & le Souef, 1900, *Anim. Austral.* : 269, figs. ; Andersson, 1913, *Svenska Vetensk. Akad. Handl.*, **52**, **4** : 9; Harrison, 1922, *Aust. Zool.*, **3**, **1** : 33; Nieden, 1923, *Das Tierreich*, *Anura* I : 529; Trewavas, 1933, *Phil. Trans. roy. Soc. Lond.*, **222**, **B** : 435, fig. 25.
- Wagleria peronii* Girard, 1853, *Proc. Acad. nat. Sci. Philad.*, **6** : 421; *idem*, 1858, *U.S. Explor. Exped.*, *Herpet.* : 42, pl. 3, figs. 29-33.
- Limnodynastes peronii peronii* Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 17.
- Limnodynastes krefftii* Günther, 1863, *Ann. Mag. nat. Hist.*, (3), **11** : 26 (Type locality :— near Sydney); Krefft, 1865, *Pap. roy. Soc. Tasmania* : 16; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.* : 107; Steindachner, 1867, *Reise Novara, Zool., Amph.* : 26; Günther, 1868, *Proc. zool. Soc. Lond.* : 480.
- Limnodynastes peronii* var. *krefftii* Kesterstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 345; *idem*, 1868, *Arch. Naturgesch.*, **34** : 258.
- Limnodynastes lineatus* de Vis, 1884, *Proc. Linn. Soc. N.S.W.*, **9** : 65 (Type locality :— Mackay).
- Limnodynastes peronii lineatus* Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 18.
- Limnodynastes dorsalis dorsalis* (part; spec. 19371) Loveridge, 1934, *Pap. roy. Soc. Tasmania* : 58; *idem*, 1935, *Bull. Mus. Comp. Zool. Harv.*, **78** : 21.

Vomerine teeth in long curved series separated from the maxillae by a space not greater than half the length of one series. Snout rounded, distinctly prominent, 1.6 to 1.8 times as long as the eye, with rounded canthus rostralis and moderately oblique loreal region; nostril midway between the tip of the snout and the eye or a little nearer the latter; interorbital space subequal to the width of the upper eyelid; tympanum indistinct or hidden, $\frac{2}{3}$ to $\frac{3}{4}$ the diameter of the eye (exposed by dissection). Fingers depressed, the two inner with more or less distinct marginal seams; first not extending quite as far as the second, with two very small, subequal phalanges, or with but a single one (Pl. I, figs. E, F); the first metacarpal greatly elongate and much longer than the second; subarticular tubercles distinct, except on the first finger; no supernumerary tubercles or papillae between the fingers; a prominent inner metacarpal tubercle, with a bony prepollex in males, and a longitudinally cleft outer. Toes long, slender, rounded, without marginal seams and almost completely free from web; an oval inner, but no outer metatarsal tubercle. Tibio-tarsal articulation reaching the eye.

Skin smooth with some flat glands which may form longitudinal series; a pronounced glandular ridge from beneath the eye to the fore-limb; smooth beneath; anal region feebly granular.

Pale brown or grey above, with dark brown markings in the form of rows of spots or longitudinal stripes arranged thus. A median dorsal stripe commencing on the synciput, broadening between the eyes, narrowing and running almost to the vent; this marking is often bisected lengthwise by a white or yellow vertebral line. A dorso-lateral stripe or series of spots commences behind the upper eyelid and runs parallel with the dorsal stripe to the groin. Flanks with some scattered spots; a curved band from the tip of the snout, along the canthus rostralis, through the eye to the fore-limb; sub-aural fold white or yellow. Limbs with insuliform spots. Lower surfaces white, stippled with pale brown.

In some northern specimens, described as *lineatus* by de Vis, the longitudinal stripes are very regular and clearly marked, but the available material is insufficient to decide whether or not this is a general characteristic of all northern frogs. Loveridge (1935 : 18) regards *lineatus* as a distinct race, with a rather shorter leg than the southern typical form, but in the two cotypes of *lineatus* examined by the present author the hind-limbs are quite as long as in any specimens from the south.

Males have a vocal sac opening by a slit on each side of the tongue and in the breeding season the first finger is much swollen, though apparently without any spinose nuptial pad; instead, the metacarpal appears to furnish the means of gripping the female, for the phalanges are dislocated from its tip and lie at right angles to the axis of the digit, very much as in the African *Petrophedetes johnstoni*. Some specimens seem to have indications that the bone may at times perforate the skin, as in some Ranids, to form a nuptial spine. In breeding females the first and second fingers are depressed and spatulate, with fleshy lateral fringes, more developed on the pre- than post-axial edges.

Length from snout to vent: ♂ 61 mm.: ♀ 58 mm.

DISTRIBUTION: Queensland, New South Wales, Victoria, Tasmania.

The species breeds at any time of the year, following rain, and shallow, grassy pools are preferred as the spawning site. The call is an explosive "toc." The egg-mass is similar to that of *L. tasmaniensis* (q.v.) but larger, 4-6 in. in diameter and is usually found entangled in the sedges at the margins of the pool.

SPECIMENS EXAMINED.

B.M.	70.6.26.46-47	♂♀	Australia (?Queensland).	Krefft.
	70.6.26.55	♂	Queensland.	"
	84.7.4.1-2	♂, ♀	Mackay, Queensland.	Ling Roth. (Cotypes of <i>L. lineatus</i> de Vis.)
	63.6.16.89-91	3 juvs.	Sydney.	Krefft. (Cotypes of <i>L. krefftii</i> Günther.)
	63.6.16.85	♂	"	"
	63.6.16.?	♀	"	"
	62.8.1.29	♀	Sydney.	(Stevens.)
	87.7.16.7	juv.	"	Fletcher.
	88.7.3.5-6	2 ♀♀	Burrawang, N.S.W.	"
	1925.9.19.1	Hgr.	Nowra, N.S.W.	Rodway.
	88.7.3.4	♂	Warragul, Gippsland, Victoria.	Baker.
	45.5.25.7	♂	?	C. Darwin.
	60.6.19.34-35	♂♀	[Erromango.]	(Cuming.)
Mus.	Leiden 4251	♂	Queensland.	(Godeffroy Mus.)
"	" 1729	♂♀	Sydney.	(Sydney Mus.)
"	" 1864	♂, 3 Hgr.	?	(" ")
B.M.	58.11.25.57	♂	" Van Diemen's Land "	Sir A. Smith.
M.C.Z.	Harvard 19371	♀	Stanley, Tasmania.	Scott.
Austr. Mus.	R.8490 (part)	juv.	Tweed River, N.S.W.	

PHILORIA Spencer.

Philoria Spencer, 1901, *Proc. roy. Soc. Victoria*, (2), 13: 176 (Type species:—*Philoria frosti*); Nieden, 1923, *Das Tierreich*, *Anura* I: 537; Noble, 1931, *Biol. Amph.*: 498.

Maxillary teeth present. Prevomer present, entire, its post-choanal portion overlying the mesial half of the palatine and dentigerous, the teeth forming oblique series nearly in contact mesially, but not extending laterally beyond the inner borders of the choanae; a distinct fronto-parietal foramen. Ear fully developed. Vertebrae procoelous, but with the condyle incompletely ankylosed and the notochord persistent; seven presacra(?)¹; sacral diapophyses moderately

¹ In the single specimen examined there are only 5 free pre-sacral vertebrae of which the foremost represents 1 + 2 fused. But fused with the sacrum anteriorly are two other centra, the transverse processes of which are small but free from the sacral diapophyses. It seems probable that this shortening of the vertebral column may be an individual anomaly, but should it prove to be normal it provides a very sharp distinction from all other members of the subfamily.

strongly dilated; coccyx articulating by two condyles. Omosternum cartilaginous. Terminal phalanges simple. Distal tendon of the m. semitendinosus passing ventral to the head of the gracilis. Alary processes of the hyoid small and antero-lateral, as in *Limnodynastes*.

Pupil horizontal with a ventral angle. Tongue heart-shaped, slightly free behind. Toes quite free, not or but slightly dilated distally.

These characters are taken from a single specimen of what appears to be a northern species of *Philoria* and not from the genotype, which is not available to the author for examination. There is thus room for doubt as to whether the two really are congeneric and whether the foregoing diagnosis is really applicable to *Philoria*. If it is, however, the genus is very closely allied to *Limnodynastes* and differs only in the absence of digital webbing and the reduction of the digits, a character in which it resembles *Crinia*.

Philoria frosti Spencer.

Philoria frosti Spencer, 1901, *Proc. roy. Soc. Victoria*, (2), **13**: 176 (Type locality:—Mt. Baw Baw, Victoria); Lucas & le Souef, 1909, *Anim. Austral.*: 283; Nieden, 1923, *Das Tierreich*, Anura I: 537.

Habitus stout. Head broader than long; snout rounded, slightly longer than the orbital diameter; nostril nearer to the eye than the tip of the snout; canthus rostralis not strongly marked. Interorbital space as broad as the length of the orbit. Tympanum not visible. Fingers blunt and free; first finger not extending so far as the second. Toes short and blunt, no trace of webbing; subarticular tubercles present; three metacarpal tubercles, the inner one strongly, the outer feebly developed. The inner metatarsal tubercles small and blunt. Hind limbs short, stout and strongly built; carried forwards the tibio-tarsal articulation barely reaches as far forwards as the shoulder. Upper eyelids, tympanic region, the top of the head and dorsal surface of the body, the upper surface of the arm and fore arm and the upper surface of the leg covered with small warts arranged in roughly longitudinal rows along the back. A very large and prominent triangular shaped parotoid gland is present on either side extending backwards over the shoulder region; the longest side of the triangle runs parallel to the mid-dorsal line, and these two sides are separated from one another by a space which is narrower than that between the orbits. From the posterior angle a special row of warts somewhat larger than the rest runs backwards to the groin and is continued forwards over the surface of the gland, which is otherwise comparatively smooth. Upper surface of body and limbs a general dark brown colour with here and there small irregular light patches; groins and under surface of body and limbs yellowish, mottled with brown.

Length from snout to vent: 44 mm.

Habitat: Mount Baw Baw, Victoria (Spencer).

Philoria loveridgei sp.n.

Philoria frosti Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 16.

Habitus moderately stout. Head as long as, or longer than, broad; snout subacuminate, 1.4 times as long as the eye; nostril much nearer the eye than the tip of the snout; canthus rostralis sub-angular; loreal region slightly oblique and distinctly concave; interorbital space 1.2 to 1.5 times as broad as the upper

eyelid; tympanum just discernible, or hidden, its horizontal diameter half that of the eye. Fingers very short, the first much shorter than the second; small subarticular tubercles beneath the proximal joints; two metacarpal tubercles, the outer largest and notched distally. Toes rather short, quite free, their tips slightly spatulate; subarticular tubercles feebly developed; a small inner, and no outer, metatarsal tubercle. Tibio-tarsal articulation reaching the tympanic region in males, or not quite so far in females.

Skin slightly warty or quite smooth above; a supratympanic fold but no distinct parotoid gland. Smooth beneath.

Brown above, almost uniform, but the edge of the upper lip spotted with lighter. Loreal and tympanic regions darker, the edge of the supratympanic fold lighter; flanks with some large dark spots; groins and axillae white (? red in life). Lower surfaces white, the chin and throat profusely and the belly sparsely dotted with dark brown.

Length from snout to vent: ♂ 25.5 mm.; ♀ 33 mm.

DISTRIBUTION: Macpherson Range, 3-4000 ft., S. Queensland.

MATERIAL EXAMINED.

B.M. 1933.4.8.6 ♀ Macpherson Range, 3-4000 ft. Darlington. TYPE.

This specimen is one of the series recorded as *P. frosti* by Loveridge. No material of Spencer's species is available for comparison, but there are a number of differences between the description of *frosti* and these northern frogs, which suggest that the two are not conspecific. Both species appear to be montane forms.

NOTADEN Günther.

Notaden Günther, 1873, *Ann. Mag. nat. Hist.*, (4), **11**: 349 (Type species:—*Notaden bennetti*); Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 328; Cope, 1889, *Bull. U.S. nat. Mus.*, **34**: 260; Nieden, 1923, *Das Tierreich, Anura I*: 162; Noble, 1931, *Biol. Amph.*: 498.

Maxillary teeth absent. Prevomer bordering the choana anteriorly and sending a branch diagonally backwards towards its fellow; this branch is raised into a knob-like prominence at its extremity on a level with the mesial ends of the palatines and bears a few teeth or tooth-like structures; a large fronto-parietal foramen; ear fully developed, the extra-plectal cartilage large, but not as large as the tympanum. Vertebrae procoelous with the condyle incompletely ankylosed and the notochord persistent; 7 presacra; sacral diapophyses moderately strongly dilated; coccyx articulating by two condyles. Omosternum small, cartilaginous; sternum cartilaginous or calcified, undivided. Terminal phalanges simple.

Distal tendon of the m. semitendinosus passing ventral to the mm. graciles. Alary processes of the hyoid narrow proximally, expanded distally.

Pupil horizontal. Tongue subcircular, adherent. Palate with a series of two or three smooth transverse folds in front of the pharynx. Digits not dilated.

SYNOPSIS OF THE SPECIES.

1. First finger shorter than the second; inner metatarsal tubercle 1.2 to 2.0 times as long as its distance from the tip of the inner toe. Dorsal markings forming a cruciform or Ξ -shaped pattern. *N. bennetti*.

- II. First finger as long as, or longer than, the second; inner metatarsal tubercle as long as its distance from the tip of the inner toe. Dorsal markings not forming a definite pattern *N. nichollsi*.

Notaden bennetti Günther.

Notaden bennetti Günther, 1873, *Ann. Mag. nat. Hist.*, (4), **11** : 350 (Type locality :—Castle-reagh River); Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 328, pl. 27, fig. 3; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 360; *idem*, 1890, *op. cit.*, (2), **5** : 672-675; *idem*, 1891, *op. cit.*, (2), **6** : 265, 271, 272; *idem*, 1892, *op. cit.*, (2), **7** : 12; *idem*, 1894, *op. cit.*, (2), **8** : 530, 531; Lucas & le Souef, 1909, *Anim. Austral.* : 286, fig.; Nieden, 1923, *Das Tierreich, Anura* I : 162, fig. 212; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 37.

Habitus globose. Head broader than long, its width contained about 3.75 times in the length from snout to vent. Snout short and deep, about as long as the eye, vertically truncate and not prominent; canthus rostralis rounded; loreal region vertical; nostrils subterminal; interorbital space as broad as, or broader than, the upper eyelid; tympanum hidden. Fingers rather short, depressed, the first shorter than the second, which is longer than the fourth; small subarticular tubercles beneath the metacarpo-phalangeal joints and indications of tubercles between the first and second and second and third fingers; two rather indistinct metacarpal tubercles. Toes short, depressed, with fleshy lateral fringes and basal webbing which midway between the third and fourth toes reaches the middle of the proximal phalanx of the third toe; no subarticular tubercles; a large shovel-shaped inner metatarsal tubercle which is 1.5 to 2.0 times as long as its distance from the tip of the inner toe. Hind limb, measured from the vent to the tip of the fourth toe with the leg extended at right angles to the body, as long as the distance between the vent and the anterior corner of the eye or the nostril.

Skin very thick and glandular with closely set, raised warts except for 5 patches which are almost smooth and disposed as follows: a cruciform patch on the head, the transverse bar connecting the upper eyelids anteriorly and the longitudinal member running backwards to the nape; a latero-dorsal sub-circular patch above each arm, and a similar, but larger pair above the middle of each flank; a linear zone, less defined than the remainder, along the coccyx. Gular region and chest smooth; belly feebly granular and wrinkled; circum-anal region with scattered small pimples.

Colour pattern following the arrangement of the warts, which are dark brown or black often stippled with white, on a greenish background with isolated patches of rusty- or orange red; the smooth areas are lighter, bright or greenish-yellow. Lower surfaces yellowish white, the throat and chest spotted with brown.

Length from snout to vent; ♀ 45 mm.

The species is cryptozoic, frequenting the dry areas of inland New South Wales and southern Queensland; it is myrmecophagous and seldom seen above ground except after rain. The skin exudes a milky venom when the frog is handled.

DISTRIBUTION: Plains of New South Wales and southern Queensland west of the dividing range.

SPECIMENS EXAMINED.

B.M.	73.4.30.17	♀	Castlereagh River.	(Sydney Mus.)	} COTYPES.
	73.4.30.6	♀	"	Bennett.	
	90.12.18.1	♀	Dandaloo, N.S.W.	Fletcher.	
	81.12.6.1	juv.	Wilson's River, Queens- land.	(Gerrard.)	

Notaden nichollsi sp. n.

Notaden bennetti (non Günther) Andersson, 1913, *K. Svenska Vetensk Akad. Handl.*, **52**, 4 : 20, pl. 1, figs. 7, 8.

Habitus globose. Head broader than long, its width contained 3.4 to 3.6 times in the length from snout to vent. Snout short and deep, not prominent, obtusely rounded and truncate; canthus rostralis rounded; loreal region oblique; nostril midway between the eye and the end of the snout; interorbital space as broad as or a little broader than the upper eyelid; tympanum hidden. Fingers rather short; in adults the first as long as or slightly longer than the second which is longer than the fourth; in juveniles the first is shorter than the second; small subarticular tubercles beneath the proximal joints of the fingers; two rather indistinct metacarpal tubercles. Toes short, depressed, with thick, fleshy fringes and webbing which between the third and fourth reaches nearly or quite to the level of the distal end of the proximal phalanx of the third; no subarticular tubercles; a compressed inner metatarsal tubercle as long as or very slightly longer than its distance from the tip of the inner toe in adults; distinctly shorter in the very young. Length of the hind-limb, measured from the tip of the fourth toe to the vent with the leg extended at right angles to the body, as long as the distance from vent to eye.

Skin very thick and glandular with larger and smaller warts uniformly distributed; sometimes there may be some larger warts forming a very indefinite linear series dorso-laterally from the posterior corner of the eye. Lower surfaces smooth or wrinkled; anal region with scattered pimples.

Adults olive-grey or brown above, the larger warts brown or blackish; there is often no defined colour pattern but sometimes traces of a faint, interorbital triangle, its apex directed backwards, may be discerned, and where the warts have a linear arrangement interrupted irregular dark lines may be apparent or groups of dark warts with a faintly cruciform arrangement. Warts on the flanks tipped with yellow. Lower surfaces uniform yellowish white. Throat of the male infuscate.

Juveniles at metamorphosis with a well-defined pattern. Ground-colour silvery grey; a curved dark-brown streak along the canthus rostralis and a large triangular interorbital marking, the apex directed posteriorly; a series of three dark triangles on each side, apices directed ventrally and their bases sub-continuous to form a dorso-lateral stripe; the light median zone thus cut off with two dark spots one about the middle of the back and one in front of the sacrum. Scattered warts on the back and sides white-tipped. Limbs silver-grey with dark cross bars.

Male with a vocal sac; diffuse nuptial pads on the inner surfaces of the first and second fingers and a series of pustules capped with horny spinules beneath the lower jaw.

Length from snout to vent: ♂ 63 mm.; ♀ 64 mm.

Juveniles at metamorphosis (tail incompletely resorbed): 12 mm.

DISTRIBUTION: Northern West Australia.

SPECIMENS EXAMINED.			
B.M. 96.7.2.19	♂	Roebuck Bay, W.A.	Dahl. HOLOTYPE.
1937.7.22.36-40	3 ♂♂, 2 ♀♀	Rabbit-Proof Fence No. 1, Far North, W.A.	Nicholls. PARATYPES.
Swedish Mus. 1569	♀	Noonkambah, Kimberley Divn., W.A.	Mjöberg. PARATYPES.
" " 1570	♀	St. George Range, Kimberley Divn., W.A.	" "
" " 1568 (part)	♂, 4 juvs.	Mowla Down, Mt. Alexander, 70 miles south of Fitz Roy River, Kimberley Divn., W.A.	" "

Subfamily MYOBATRACHINAE.

- CYSTIGNATHI (part) Tschudi, 1838, *Mém. Soc. neuchâtel. Sci. nat.*, **2** : 37, 78.
 RANIFORMES (part) Duméril & Bibron, 1841, *Erpét. Gén.*, **8** : 317.
 ALYTAE (part) + BOMBITATOIRES (part) Fitzinger, 1843, *Syst. Rept.* : 32.
 MYOBATRACHIDAE, MYOBATRACHINA Bonaparte, 1850, *Consp. Syst. Herp., Amph.*
 MYOBATRACHIDAE Schlegel, 1850, *Proc. zool. Soc. Lond.* : 10.
 MYOBATRACHIDAE + CYSTIGNATHIDAE (part) + UPEROLIIDAE + BRACHYCEPHALIDAE (part) + ENGYSTOMATIDAE (part) Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 3, 26, 39, 45, 51.
 BRACHYMERIDAE (part) + BUFONIDAE (part) + SCAPHIPODIDAE (part) + CYSTIGNATHIDAE (part) Cope, 1865, *Nat. Hist. Rev.*, n.s., **5** : 97-120.
 CYSTIGNATHIDAE, CRINIAE (part) Cope, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6** : 67-97.
 BUFONIDAE (part) Cope, 1866, *tom. cit.* : 189.
 ALYTIDAE (part) + PHRYNISCIDAE (part) Steindachner, 1867, *Reise Novara, Zool., Amph.* : 7-34.
 CYSTIGNATHIDAE (part) + UPEROLEIIDAE Kefenstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 343-349.
 CYSTIGNATHIDAE (part) + ALYTIDAE (part) + PHRYNISCIDAE + ENGYSTOMIDAE (part) Kefenstein, 1868, *Arch. Naturgesch.*, **34** : 251-273.
 PHRYNISCIDAE, PHRYNISCINA (part) + ENGYSTOMIDAE, BREVICIPITINA (part) + ALYTIDAE, UPEROLIINA (part) + RANIDAE, CYSTIGNATHINA Mivart, 1869, *Proc. zool. Soc. Lond.* : 288-294.
 CYSTIGNATHIDAE (part) + BUFONIDAE (part) Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 183-132.
 BUFONIDAE (part) Noble, 1922, *Bull. Amer. Mus. nat. Hist.*, **46** : 1-87.
 CERATOPHRIIDAE (part) + BUFONIDAE (part) Waite, 1929, *Rept. Amph. S. Australia* : 244-266.
 BUFONIDAE, CRINIINAE (part) Noble, 1931, *Biol. Amph.* : 496.
 LEPTODACTYLIDAE (part) Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 8.

Tongue narrowly oval or small; intermaxillary glands opening by not more than two ducts close to the mid-line of the palate. Prevomer much reduced or absent; vomerine teeth vestigial or absent (text-figs. 13-15). Alary processes of the hyoid wing-like expansions of the lateral border of the hyoid plate (text-fig. 3, p. 5); sternohyoid and petrohoid muscles attached to the ventral surface of the hyoid, approaching the mid-line posteriorly. Distal tendon of the m. semitendinosus perforating the mm. graciles or their distal tendon, or passing dorsal to them. Sterno-epicoracoideus absent (*Uperoleia*). Presacral vertebrae 8, and the notochord always more or less persistent.

KEY TO THE GENERA.

I. Ear fully developed.

A. Maxillary teeth present.

- (1) Toes webbed; a large fronto-parietal foramen . . . *Glauertia*.
 (2) Toes free.
 (a) Fronto-parietal foramen closed in the adult . . . *Uperoleia*.
 (b) Fronto-parietal foramen persistent, large . . . *Crinia*.

B. Maxillary teeth absent.

- (1) Toes webbed ; a large fronto-parietal foramen . . . *Glauertia*.
- (2) Toes free.
 - (a) Fronto-parietal foramen closed in adults . . . *Uperoleia*.
 - (b) Fronto-parietal foramen large, persistent.
 - (i) Clavicles broad mesially ; epicoracoids meeting edge to edge anteriorly (text-fig. 20) . . . *Myobatrachus*.
 - (ii) Clavicles not dilated ; epicoracoids overlapping . *Metacrinia*.

II. No tympanum, cavum tympani, annulus tympanicus, columella (plectrum) or Eustachian tubes ; maxillary teeth absent *Pseudophryne*.

GLAUERTIA Loveridge.

Pseudophryne (part) Andersson, 1913, *K. Svenska Vetensk.Akad. Handl.*, **52**, 4 : 19 ; Nieden, 1923, *Das Tierreich, Anura I* : 150.
Glauertia Loveridge, 1933, *Occ. Pap. Boston Soc. nat. Hist.*, **8** : 89 (Type species :—*Glauertia russelli*).

Maxillary teeth present or absent. Prevomer absent ; fronto-parietal foramen very large and persistent, the fronto-parietal bones being confined to the lateral regions of the cranium. Ear fully developed. Vertebrae procoelous,¹ but the condyle incompletely ankylosed ; sacral diapophyses moderately dilated ; 8 presacral vertebrae ; coccyx articulating by two condyles. Omosternum rudimentary ; sternum large, cartilaginous. Terminal phalanges simple.

Distal tendon of the m. semitendinosus passing through the tendon of the gracilis complex (*G. orientalis*) or passing dorsal to it (*G. russelli*). Alary process of the hyoid a wing-like expansion of almost the whole lateral margin of the hyoid plate.

Pupil horizontal with a ventral angle. Tongue small, oval, $\frac{1}{3}$ free behind. Tympanum hidden. Digits not dilated ; toes webbed.

The species of this genus appear to be closely allied and to be descended from some Crinine stock. They may be distinguished from the true *Crinias* by their webbed toes. This difference, in itself, seems trivial enough, but the fact remains that these web-footed species represent one line of descent whereas the unwebbed species, whether with or without teeth, are a separate evolutionary branch. To include all of them in the same genus would mask their phylogeny and this seems adequate justification for the retention of *Glauertia* as a distinct, if not very easily diagnosable, genus.

SYNOPSIS OF THE SPECIES.

I. Maxillary teeth present ; a tarsal tubercle ; toes webbed at the base

G. mjobergi (Andersson).

II. Maxillary teeth absent ; no tarsal tubercle.

A. Toes half webbed *G. russelli* Loveridge.

B. Toes $\frac{1}{4}$ to $\frac{1}{3}$ webbed *G. orientalis* sp. nov.

¹ One specimen examined appears diplasiocoelous, but owing to the incomplete fusion of the condyle this might be an artefact.

Glauertia mjobergi (Andersson).

Pseudophryne mjobergi Andersson, 1913, *K. Svenska Vetensk. Akad. Handl.*, **52**, 4 : 19, pl. 1, figs. 5, 6 (Type locality :—Noonkambah, Kimberley Divn., W. Australia); Nieden, 1923, *Das Tierreich, Anura* 1 : 150, fig. 197; Harrison, 1927, *Rec. Aust. Mus.*, **15** : 284; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 9.

Head as long as broad; snout truncate, very slightly longer than the eye; nostrils directed upwards, nearer the tip of the snout than the eye; canthus rostralis rounded; loreal region slightly oblique; interorbital space convex, once and a third as wide as the upper eyelid; tympanum hidden; occiput swollen. Fingers free, not dilated, the first much shorter than the second, which is a little shorter than the fourth; subarticular tubercles well developed; palm with rows of small tubercles; two large metacarpal tubercles. Toes with a distinct rudiment of web and fleshy lateral fringes; fifth much shorter than the third; subarticular tubercles conical; two large, shovel-shaped metatarsal tubercles, the outer obliquely transverse; a conical papilla on the lower surface of the tarsus, close to the tibio-tarsal articulation. Tarso-metatarsal articulation reaching the posterior corner of the eye.

Skin with scattered small warts above; a large parotoid gland; a similar gland along the flanks to the groin and a smaller gland on each side of the coccyx. Smooth beneath, except the hinder sides of the thighs which are granular.

Pale grey above with a few large insuliform spots of which the most prominent are a kidney-shaped pair bordering the parotoid glands above; the small warts light-tipped. Lower surfaces white.

Length from snout to vent : 20 mm.

DISTRIBUTION : Known only from the type locality, Noonkambah, Kimberley Divn., W. Australia.

SPECIMEN EXAMINED.

Swedish Mus. 1567

♀

Noonkambah

Mjöberg. COTYPE.

Glauertia russelli Loveridge.

Glauertia russelli Loveridge, 1933, *Occ. Pap. Boston Soc. nat. Hist.*, **8** : 89 (Type locality :—Gascoyne River, near Landor Station, W. Australia); *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 37, pl. 1, figs. 1-3.

Head broader than long; snout triangular, truncate distally, a little longer than the diameter of the eye; nostrils directed upwards, nearer the tip of the snout than the eye; canthus rostralis rounded; loreal region nearly vertical, slightly concave; interorbital space flat, once and a half to twice as broad as the upper eyelid; tympanum hidden. Fingers free, not dilated; first much shorter than the second which does not extend as far as the fourth; subarticular tubercles well developed; palm with rows of small tubercles; two metacarpal tubercles. Toes half webbed, the membrane midway between the third and fourth reaching the level of the distal subarticular tubercle of the third; fifth much shorter than the third; subarticular tubercles well developed; two large shovel-shaped metatarsal tubercles, the outer transversely disposed. Tarso-metatarsal articulation reaching the anterior corner of the eye in juveniles or the axilla in adults.

Skin warty above; more or less granular on the abdomen and beneath the thighs.

Brown above with indistinct darker spots and with or without a light (pink in life) vertebral stripe; a light blotch on each scapular region (reddish

orange in life) and a similar but smaller spot may be present on each side of the coccyx; the two may be more or less connected by an indefinite zone of the same colour. Dirty yellow beneath, the throat sometimes freckled with brown.

Length: ♂ 23.5 mm.; ♀ 30 mm.

DISTRIBUTION: Known only from the type locality.

SPECIMENS EXAMINED.

Stellenbosch Univ. Colln.	2 juvs.	Landor Sta., W. Austr.	Glauert.	PARATYPES.
B.M. 1937.7.23.3-5	♀♀, Hgr.	"	"	"

Glauertia orientalis sp. nov.

Pseudophryne fimbrianus ? Parker, 1926, *Ann. Mag. nat. Hist.*, (9), **17** : 670 (Groote Eylandt).

Holotype a male, number 1908.2.25.34 in the British Museum from Alexandria Station (19° 08' S., 136° 43' E.), Northern Territories, Australia, collected by W. Stalker.

Head a little broader than long; snout short, vertically truncate, shorter than the eye; nostrils directed vertically upwards, close to the tip of the snout; canthus rostralis rounded; loreal region slightly oblique; interorbital space once and a third the width of the upper eyelid; tympanum hidden. Fingers free, the first shorter than the second, which does not extend quite as far as the fourth; subarticular tubercles well developed; palm with rows of small, round tubercles; two metacarpal tubercles. Toes a quarter webbed, the edge of the membrane midway between the third and fourth not extending beyond the proximal tubercle of the fourth toe; edge of the membrane raised into a tubercle; fifth toe much shorter than the third. Two large, compressed metatarsal tubercles, the outer disposed transversely. Tarso-metatarsal articulation reaching the tympanic region.

Skin slightly warty above; a moderately distinct parotoid gland and a smaller, circular inguinal gland. Lower surfaces feebly granular except beneath the thighs where the granulations are more pronounced.

Brown above, each wart lighter and ringed with darker; faint indications of a light, mid-dorsal line; parotoid and inguinal glands rufous. Lower surfaces dirty white, the gular region infusate. Hinder side of thighs brown with a light (non-glandular) spot behind the knee.

A vocal sac opening internally by a slit on each side close to the lower jaw; base of the first finger on its inner side thickened and glandular.

Length from snout to vent: 26 mm.

Hind limb: 29 mm.

PARATYPES: Two males from the type locality, and a female from Groote Eylandt.

These examples show little variation. The parotoid and inguinal glands are not always clearly defined and the digital webbing of the toes is not absolutely constant, varying from $\frac{1}{4}$ to $\frac{1}{3}$; in none of them is it as extensive as in *G. russelli*. The female has a deeply fimbriated cloacal flap, as in the genus *Uperoleia*.

These eastern specimens appear to differ constantly from the western *G. russelli* in their shorter digital webbing and slightly shorter more acuminate snouts; but it must be admitted that with reasonably long series, these differences may not be found to hold good and that the two forms may not be tenable.

SPECIMENS EXAMINED.

B.M. 1908.2.25.34	♂	Alexandria Sta., N. Territory.	Stalker. HOLOTYPE.
1908.2.25.35-36	♂♂	Alexandria Sta., N. Territory.	„ PARATYPES.
1926.2.25.2	♀	Groote Eylandt.	Wilkins. PARATYPE.

UPEROLEIA Gray.

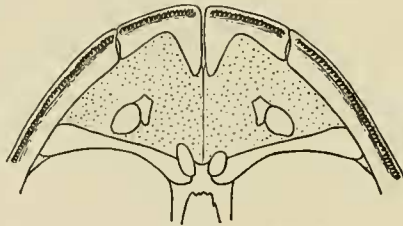
*Uperoleia*¹ Gray, 1841 (April), *Ann. Mag. nat. Hist.*, 7 : 90 (Type species :—*Uperoleia marmorata*) ; Gray, 1841, in Grey, *Journ. Exped. Austral.*, 2 : 448 ; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 39 ; Steindachner, 1867, *Reise Novara, Zool., Amph.* : 33 ; Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, 18 : 349 ; Günther, 1867, *Ann. Mag. nat. Hist.*, (3), 20 : 55 ; Keferstein, 1868, *Arch. Naturgesch.*, 34 : 270.

Uperoleja Gray, 1841, *tom. cit.* : 436.

*Hyperolia*¹ (emend.) Cope, 1865, *Nat. Hist. Rev.*, n.s., 5 : 108 ; *idem*, 1866, *J. Acad. nat. Sci. Philad.*, (2), 6 : 94 ; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 267 ; Cope, 1889, *Bull. U.S. nat. Mus.*, 34 : 312 ; Nieden, 1923, *Das Tierreich, Anura I* : 535 ; Noble, 1931, *Biol. Amph.* : 498.

Pseudophryne (part) Andersson, 1916, *K. Svenska VetenskAkad. Handl.*, 52, 9 : 13 ; Parker, 1926, *Ann. Mag. nat. Hist.*, (9), 17 : 669.

Maxillary teeth present or absent. Prevomer reduced to two fragments, one bounding the choana and the other overlying the mesial end of the palatine (*U. rugosa*, text-fig. 13) or completely absent (*U. marmorata*) ; fronto-parietal



TEXT-FIG. 13.— Anterior cranial elements of *Uperoleia rugosa*. × 6.5. (From beneath.)

foramen present in juveniles, but completely roofed over in the adult. Ear fully developed. Vertebrae procoelous, but the condyle incompletely ankylosed ; eight pre-sacrales ; sacral diapophyses moderately dilated ; coccyx articulating by two condyles. Omosternum rudimentary ; sternum small, cartilaginous. Terminal phalanges simple. Distal tendon of the m. semitendinosus perforating the gracilis complex.

Alary process of the hyoid a wing-like lateral expansion of the whole of the border of the hyoid plate.

Pupil rhomboidal, often somewhat vertically compressed. Tongue oval, entire and free behind. Tympanum hidden. Parotoid glands large and prominent. Digits free, not dilated.

The relationships of this genus are discussed below, under *Pseudophryne*.

¹ Under Art. 19 of the Rules of Nomenclature the original orthography of a name may be emended when, *inter alia*, an error of transliteration "is evident." What is "evident" is not capable of rigid definition, so that it seems advisable to consider names as arbitrary combinations of letters except when their derivation is expressly stated in the original publication of the name. Gray does not state the etymological derivation of *Uperoleia* and so, although Cope's emendation to *Hyperolia* is probably based on a perfectly correct assumption, there is no sure proof. Consequently it seems preferable to continue the use of the name as it was originally proposed, the more so since this course will not involve any change of the name *Hyperolius* Rapp, 1842.

Despite Loveridge's (1935 : 31) contention that *rugosa* Anderson is at most racially distinct from *marmorata*, there appear to be sufficient well-marked differences to indicate that they are truly specifically distinct. Harrison (1927 : 284) suggested "with some diffidence" that *Pseudophryne mjobergi* Andersson might be a synonym of *U. marmorata*, but the species appears to be referable to the genus *Glauertia*.

SYNOPSIS OF THE SPECIES.

- I. Maxillary teeth present ; metatarsal tubercles not compressed ; snout rounded *U. marmorata*.
- II. Maxillary teeth absent ; metatarsal tubercles distinctly shovel-like, the outer disposed transversely ; snout truncate *U. rugosa*.

Uperoleia marmorata Gray.

Uperoleia marmorata Gray, 1841 (April), *Ann. Mag. nat. Hist.*, **7** : 90 (Type locality :—Western Australia) ; Gray, 1841, in Grey, *Journ. Exp. Austral.*, **2** : 448 ; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 39 ; Krefft, 1865, *Pap. roy. Soc. Tasmania* : 17 ; *idem*, 1867, *Cat. Industr. Prod. N.S.W., Add.* : 107 ; Steindachner, 1867, *Reise Novara, Zool., Amph.* : 33 ; Günther, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 55 ; Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 349 ; *idem*, 1868, *Arch. Naturgesch.*, **34** : 270, pl. 6, fig. 14 ; Harrison, 1922, *Austr. Zool.*, **3**, 1 : 31.

Hyperolius (Uperoleia) marmoratus Parker, 1881, *Phil. Trans. roy. Soc. Lond.*, **3** : 134, pl. 24, figs. 6, 7.

Hyperolia marmorata Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 267 ; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 376 ; *idem*, 1890, *op. cit.*, (2), **5** : 672-675 ; *idem*, 1891, *op. cit.*, (2), **6** : 272 ; *idem*, 1892, *op. cit.*, (2), **7** : 7-9 ; *idem*, 1894, *op. cit.*, (2), **8** : 526, 528, 530 ; Boettger, 1894, *Denkschr. med.-naturw. Ges. Jena*, **8** : 109 ; Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, **22** : 678 ; Lucas & le Souef, 1909, *Anim. Austral.* : 277 ; Nieden, 1923, *Das Tierreich, Anura I* : 535, fig. 368.

Uperoleia marmorata var. *laevigata* Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 349 (Type locality :—Raudewick, N.S.W.).

Snout rounded, a little longer than the eye ; canthus rostralis quite indistinct ; loreal region oblique, not concave ; nostril a little nearer the tip of the snout than the eye ; the distance from nostril to tip of snout contained 1.3 to 1.5 times in distance from nostril to eye ; interorbital space once and a quarter to once and a half as broad as the upper eyelid. Fingers moderate, with prominent subarticular tubercles ; the first much shorter than the second, which is a little shorter than the fourth ; carpus with rows of small tubercles ; two well-developed metacarpal tubercles. Toes with indications of fleshy, lateral fringes and prominent subarticular tubercles ; third much longer than the fifth ; two large, but not compressed, metatarsal tubercles. Tarso-metatarsal articulation reaching the eye.

Upper surfaces smooth or minutely tubercular ; a large parotoid gland ; lower surfaces smooth or feebly granular ; hinder side of thighs granular ; anal flap undivided in males, fimbriated in females.

Pale brown to dark olive above, with or without darker spots and marblings, of which the most constant are an interorbital blotch and a curved stripe on the upper borders of the parotoids. A large yellow spot in the groin and another behind the thigh close to the knee ; these areas do not appear to be glandular. Lower surfaces pale brown to dark olive, minutely stippled with lighter or pale brown mottled with darker ; chin of the male infusate.

Male with a vocal sac opening by a slit on each side of the tongue and a glandular thickening of the base and inner side of the first finger.

Length from snout to vent : ♂ 28 mm. : ♀ 31 mm.

As in *Pseudophryne bibroni*, examples from the coastal region of New South Wales are very dark in colour and may be recognizable as a distinct race.

Habits cryptozoic. Breeding in early spring (N.S.W.) ; eggs laid singly, over 200 in a clutch. Call note an explosive "akh" (Fletcher, 1889 : 376, and Harrison, 1922 : 31).

DISTRIBUTION : Australia.

SPECIMENS EXAMINED.

B.M. 41 (2) 215	♂	W. Australia.	TYPE.
64.7.9.14	♀	Sydney.	Günther.
87.7.16.1	♂	"	Fletcher.
87.7.16.2	♂ (cleared)	"	"
87.7.16.3	♂	Burrawang, N.S.W.	"
88.7.3.14	♀	"	"
1915.3.9.23	♀	Parramatta.	Schrader.
1926.2.16.1	♀	Huskisson, Jervis Bay, N.S.W.	Rodway.
1932.10.2.147-148	♀♀	W. Australia.	Reischek.
Mus. Leiden 4259	♀	Queensland.	(Mus. Godeffroy.)
Austr. Mus. R. 7981	♀	Upper Colo, via Richmond, N.S.W.	
R. 7379 (part)	♂	Burrawang, N.S.W.	

Uperoleia rugosa (Andersson).

Hyperolia marmorata (part) Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 267 (Cape York) ; Fletcher, 1890, *Proc. Linn. Soc. N.S.W.*, (2), 5 : 673 (Dandaloo).

Pseudophryne rugosa Andersson, 1916, *K. Svenska Vetensk. Akad. Handl.*, 52, 9 : 13, pl. 1, fig. 4 (Type locality :—Colosseum, Queensland).

Uperoleia marmorata rugosa Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 31.

Pseudophryne fimbrianus Parker, 1926, *Ann. Mag. nat. Hist.*, (9), 17 : 669, fig. 3 (Type locality :—St. George District, Queensland).

Snout vertically truncate, a little longer than the diameter of the eye ; canthus rostralis rounded ; loreal region nearly vertical, not concave ; distance from the nostril to the tip of the snout contained nearly twice in the distance from nostril to eye ; interorbital space once and a third as broad as the upper eyelid. Fingers depressed, the first much shorter than the second, which is a little shorter than the fourth ; subarticular and metacarpal tubercles well developed ; carpus with rows of smaller tubercles. Toes with feeble indications of fleshy lateral fringes, especially proximally, and prominent subarticular tubercles ; third much longer than the fifth ; two large, metatarsal tubercles, the outer the larger, usually distinctly transverse and shovel-like. Tarso-metatarsal articulation reaching the tympanic region.

Upper surfaces regularly warty. A distinct parotoid gland and a more or less distinct lateral gland extending from the posterior corner of the latter towards the groin and a circular gland on each side of the coccyx posteriorly. Lower surfaces feebly granular ; hinder side of thighs distinctly granular. Anal flap fimbriated in females.

Brown above with more or less profuse darker spots of which the most constant is a V-shaped interorbital bar. Posterior half of the parotoids often with a light spot. A distinct white patch in the groin and another on the thigh behind the knee ; these areas are not glandular. Lower surfaces white, dusted or spotted with brown ; chin of male infusate.

Male with a vocal sac opening by a slit on each side of the tongue, and with a thickened glandular pad on the inner side of the first finger.

Length from snout to vent: ♂ 26 mm.; ♀ 28 mm.

DISTRIBUTION: Queensland and New South Wales west of the dividing range.

SPECIMENS EXAMINED.

B.M. 67.5.6.84	♂	Cape York.	Dämel.
90.7.28.3-4	♀♀	Bogan River, Dandaloo, N.S.W.	Fletcher.
1923.11.12.3	♀	St. George Distr., Queensland.	Wilkins. (Type of <i>Pseudophryne fimbrianus</i> .)
Swedish Mus. 1630	♀	Colosseum, S. Queensland.	Mjöberg. TYPE.
Mus. Leiden 6785	♀	Queensland.	(Godeffroy Mus.)
Austr. Mus. R.7347	2 ♀♀	Emu Plains, Urana, N.S.W.	
" " R.7348	♂♀		

CRINIA Tschudi.

Crinia Tschudi, 1883, *Mém. Soc. neuchâtel. Sci. nat.*: 38, 78 (Type species:—*Crinia georgiana*); Fitzinger, 1843, *Syst. Rept.*: 32; Girard, 1853, *Proc. Acad. nat. Sci. Philad.*, 6: 420; Cope, 1865, *Nat. Hist. Rev.*, n.s., 5: 107; *idem*, 1866, *J. Acad. nat. Sci. Philad.*, (2), 6: 95; Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, 18: 347; *idem*, 1868, *Arch. Naturgesch.*, 34: 262; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 263; Cope, 1889, *Bull. U.S. nat. Mus.*, 34: 312; Werner, 1914, *Fauna S.W. Austral.*, 4: 407; Nieden, 1923, *Das Tierreich, Anura* 1: 539; Waite, 1929, *Rept. Amph. S. Austral.*: 257; Noble, 1931, *Biol. Amph.*: 498.

Cystignathus (part) Duméril & Bibron, 1841, *Erpét. Gén.*, 8, 392; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 26.

Ranidella Girard, 1853, *Proc. Acad. nat. Sci. Philad.*, 6: 421 (Type species:—*Ranidella signifera*); *idem*, 1858, *U.S. Explor. Exped., Herp.*: 44.

Pterophrynus Lütken, 1862, *Vidensk. Medd. Naturh. Foren. Kbh.*: 302 (Type species:—*Pterophrynus verrucosus*); Steindachner, 1867, *Reise Novara, Zool., Amph.*: 30.

Pterophryne Günther, 1867, *Ann. Mag. nat. Hist.*, (3), 20: 53.

Camariolius Peters, 1863, *Mber. Akad. Berlin*: 236 (Type species:—*Camariolius varius*).

Maxillary teeth present. Prevomer variable. In its most primitive condition (*leai*, *rosea*, *laevis* and *darlingtoni*) a small anterior portion, bounding the choana antero-mesially, is connected by a narrow strip with a small posterior portion overlying the mesial end of the palatine which often bears vomerine teeth. In *acutirostris* only the anterior portion bounding the choana persists, but in *georgiana*, *signifera*, *tasmaniensis* and *glauerti* both the anterior portion and a small fragment overlying the palatine mesially are present, but unconnected; the posterior portion may, or may not bear teeth. A very large fronto-parietal foramen. Ear fully developed. Vertebrae procoelous, the condyle incompletely ankylosed; notochord persistent; sacral diapophyses slightly dilated; urostyle articulating by two condyles; eight presacral vertebrae. Omosternum small, cartilaginous, not fully differentiated from the procoracoids (text-figs. 16 and 18); sternum undivided, cartilaginous; procoracoids broad. Terminal phalanges simple.

Distal tendon of the m. semitendinosus passing between the m. gracilis major and minor.

Alary process of the hyoid a wing-like expansion of almost the whole lateral margin of the hyoid plate; ericoid cartilage incomplete; oesophageal process of the ericoid broad or almost absent; m. omohyoideus absent; mm. sternohyoideus and petrohyoideus anterior inserted on the ventral surface of the hyoid, reaching the middle line in the posterior part of this insertion.

Pupil horizontal but with a downwardly directed angle ventrally. Tongue narrowly oval, partly free behind. Toes free, not or but feebly dilated distally.

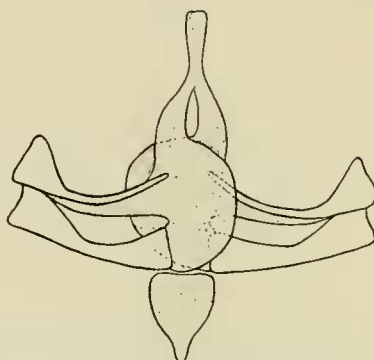
TEXT-FIG. 14.



TEXT-FIG. 15.



TEXT-FIG. 16.



TEXT-FIG. 14.—Anterior cranial elements of *Crinia laevis laevis*. $\times 6.5$. (From beneath.)

TEXT-FIG. 15.—Anterior cranial elements of *Crinia tasmaniensis*. $\times 6.5$. (From beneath.)

TEXT-FIG. 16.—Ventral elements of the shoulder girdle of *Crinia haswelli*. (Cotype ♀.)

SYNOPSIS OF THE SPECIES.

I. Prevomer undivided or with its anterior and posterior portions in contact. Vomerine teeth usually present.

A. Belly, and usually the upper surfaces also, quite smooth. Toes not fringed.

(1) Inner finger and toe not reduced, the latter $\frac{2}{3}$ the length of the second.

(a) Toes with distinct subarticular tubercles and slight terminal dilatations *C. leai*.

(b) Toes without or with very indistinct subarticular tubercles and not dilated terminally *C. rosea*.

(2) Inner finger and toe much reduced, the latter not more than half the length of the second and the inner finger with, at most, a single very short phalanx.

(a) Toes pointed; groins and hinder side of the legs marked with red and brown.

(i) Belly with a few large blotches *C. laevis laevis*.

(ii) Belly regularly dusted with brown *C. laevis victoriana*.

(b) Toes slightly dilated terminally; no red on the groins or limbs *C. darlingtoni*.

B. Belly more or less granular. Toes fringed *C. haswelli*.

- II. Prevomer divided and the two halves widely separated or the posterior absent. Vomerine teeth reduced or absent.
- A. Vomerine teeth usually present; toes not fringed; belly granular. Hinder side of thighs red in alcohol.
- (1) Snout short, rounded, 1.14 to 1.3 times the length of the eye. Average size of adults, ♂♂ 26, ♀♀ 27.3 mm. *C. georgiana*.
- (2) Snout longer, pointed, prominent, 1.35 times the length of the eye. Average size of adults 16.8 mm. *C. glauerti*.
- B. Adults with more or less distinct dermal fringes on the toes. Vomerine teeth vestigial or absent.
- (1) Belly smooth or only slightly granular.
- (a) Two metatarsal tubercles; loreal region very oblique; belly blotched with pink *C. tasmaniensis*.
- (b) A single, inner, metatarsal tubercle; loreal region nearly vertical *C. acutirostris*.
- (2) Belly granular, a tarsal fold, belly not pink.
- (a) Inner metatarsal tubercle $\frac{1}{3}$ its distance from the tip of the inner toe. Nostril equidistant from the eye and the end of the snout *C. signifera signifera*.
- (b) Inner metatarsal tubercle about half its distance from the tip of the inner toe. Nostril usually a little nearer the eye than the end of the snout.
- (i) Digital fringes well-developed, thin. Tibio-tarsal articulation reaching the tympanic region. Snout somewhat pointed and slightly prominent *C. signifera englishi*.
- (ii) Digital fringes short and fleshy. Tibio-tarsal articulation scarcely reaching beyond the shoulder. Snout bluntly rounded, not prominent *C. signifera montana*.

***Crinia leai* Fletcher.**

Crinia leai Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, **22**, 1897: 677 (Type localities:—Bridgetown and Pipe Clay Creek, near Jarrahdale); Fry, 1914, *Rec. W. Aust. Mus.*, **1**: 203, pl. 28, figs. 2, 2a; Nieden, 1923, *Das Tierreich, Anura* **1**: 543; Harrison, 1927, *Rec. Aust. Mus.*, **15**, 4: 277; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 30.

Crinia michaelsoni Werner, 1914, in Michaelson & Hartmeyer, *Fauna S.W. Australiens*, **4**: 416 (Type locality:—Donnybrook, W.A.); Nieden, 1923, *loc. cit.*

Vomerine teeth usually present in transverse series behind the level of the choanae. Snout depressed, rounded, not prominent, 1.3 times as long as the eye; canthus rostralis rounded; loreal region very oblique; nostril midway between the eye and the tip of the snout; interorbital space once and a quarter to once and a half as wide as the upper eyelid; tympanum hidden. Fingers moderately long with subarticular tubercles; palm with a few indistinct granules; two metacarpal tubercles. Toes long, distinctly spatulate distally, without dermal fringes¹; subarticular tubercles distinct but not prominent; a single, inner metatarsal tubercle; no tarsal fold. Tibio-tarsal articulation reaching the eye.

Skin smooth above and below; a distinct parotoid glandular thickening; hinder side of the thighs, beneath the vent, granular.

¹ Fletcher speaks of a "tendency to fringed toes"; Fry of a "distinct fringe or devoid of a fringe," and Werner says "Zehen gesäumt." The specimens examined have no trace of fringes, but in some of the cotypes which are somewhat shrivelled there are lateral seams on the toes.

Pinkish grey or brown above, with, in young specimens, a large rectangular, dark spot commencing between the eyes and extending backwards almost to the hind limbs. This marking may have obscure mottlings within it and is not generally completely persistent in adults. Usually with increasing age a process of emargination commences posteriorly and spreads forwards; the lateral borders are often more or less persistent, sometimes as lines, sometimes as rows of spots, and in extreme cases only a triangular dark interorbital spot persists; synciput grey; upper lip with one or two dark bars radiating from the eye; a dark stripe from the nostril through the eye, interrupted on the parotoid region and sometimes continued on the anterior part of the flanks. Limbs cross-barred; a triangular dark spot enclosing the vent, not clearly outlined below; tarsus and metatarsus blackish towards their outer edges beneath. Lower surfaces white, more or less brown freckled.

Male with a vocal sac opening by a slit on each side of the tongue and a glandular, non-rugose nuptial pad.

Length from snout to vent: ♂ 19 mm.; ♀ 25 mm.

DISTRIBUTION: Coastal belt of S.W. Australia from Albany northwards almost to Perth.

Cryptozoic in habits and frequenting damp areas.

SPECIMENS EXAMINED.

M.C.Z. 18465-75	♀	Augusta, W. Australia.	Brooks.
(part)			
Austr. Mus. R.8337	2 ♂♂, 2 juvs.	Bridgetown, W. Australia.	COTYPES.
" " R.10324	♂, 2 ♀♀, 2 juvs.	Pipe Clay Creek, "	"
" " R.10978	♀, juv.	Augusta, "	Brooks.
" " R.10959	♀, juv.	Near the mouth of the Denmark River, W.A.	

Crinia rosea Harrison.

Crinia rosea Harrison, 1927, *Rec. Aust. Mus.*, 15: 279 (Type locality:—Pemberton, in the Karri Country, 218 miles south of Perth); Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 30.

Vomerine teeth strongly developed. Snout slightly acuminate, not prominent, depressed, once and a quarter as long as the eye; canthus rostralis rounded; loreal region very oblique; nostril equidistant from the tip of the snout and the eye, or a little nearer the latter; interorbital space once and a half the width of the upper eyelid; tympanum hidden. Fingers short, pointed, with scarcely perceptible subarticular tubercles; palm smooth; metacarpal tubercles faintly indicated only. Toes moderate, pointed, not fringed, with scarcely a trace of subarticular tubercles; a very indistinct inner metatarsal tubercle; no tarsal fold; tibio-tarsal articulation reaching the shoulder.

Skin smooth above and below; no sub-anal granular patch; glandular areas behind the angle of the mouth, in the parotoid region and behind the thighs; a slight fold across the chest.

Dark purplish grey above, uniform or obscurely mottled with darker, or with a median dark zone commencing between the eyes, with parallel sides running backwards to the pelvic region, more or less deeply emarginate behind. Limbs cross-barred. Lower surfaces whitish (red in life) with some brown freckling. Gular region of male blackish.

Length from snout to vent: ♂ 22 mm.; ♀ 25 mm.

DISTRIBUTION : Pemberton, W.A.

A cryptozoic frog found under logs in wet forest country ; possibly distributed throughout the hard-wood forests of S.W. Australia.

SPECIMEN EXAMINED.

M.C.Z. 18419

♀

Pemberton, W.A.

Darlington.

Crinia laevis laevis (Günther).

Pterophrynus laevis Günther, 1864, *Proc. zool. Soc. Lond.* : 48, pl. 7, fig. 4 (Type locality :—Tasmania) ; *idem*, 1864, *Ann. Mag. nat. Hist.*, (3), 14 : 314 ; Krefft, 1865, *Pap. roy. Soc. Tasmania* : 16.

Crinia laevis Günther, 1868, *Proc. zool. Soc. Lond.* : 480 ; Keferstein, 1868, *Arch. Naturgesch.*, 34 : 265 ; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 266 ; Lucas & le Souef, 1909, *Anim. Austral.* : 276 ; English, 1910, *Proc. zool. Soc. Lond.* : 630, pl. 51, fig. 6 ; Harrison, 1922, *Aust. Zool.*, 3, 1 : 31 ; Nieden, 1923, *Das Tierreich*, Anura I : 542 (part) ; Blanchard, 1929, *Aust. Zool.*, 5, 4 : 327, pl. 35 ; Loveridge, 1934, *Pap. roy. Soc. Tasmania*, 1933 : 60 ; *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 29.

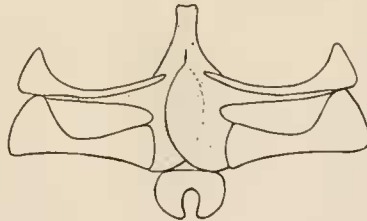
Vomerine teeth present or vestigial. Snout rounded, depressed, not prominent, 1.4 times as long as the eye ; canthus rostralis rounded ; loreal region very oblique ; nostril a little nearer the eye than the tip of the snout ; interorbital space once and three quarters as broad as the upper eyelid ; tympanum hidden. Fingers short, with scarcely perceptible subarticular tubercles ; first finger very short, with the phalanges reduced to a single, small, cartilaginous or bony nodule

TEXT-FIG. 17.



TEXT-FIG. 17.—Hand of *Crinia laevis laevis*. $\times 9$.

TEXT-FIG. 18.



TEXT-FIG. 18.—Ventral elements of the shoulder girdle of *Crinia laevis victoriana*.

at the extremity of the metacarpal ; two flat, indistinct metacarpal tubercles ; palm smooth. Toes short, not fringed, the inner short, but variable in length, with one or two (type) phalanges ; subarticular tubercles scarcely indicated ; a very indistinct inner metatarsal tubercle, but no outer, and no tarsal fold. Tibio-tarsal articulation reaching the vicinity of the shoulder.

Skin smooth above or with a few scattered tubercles ; smooth below ; a parotoid glandular thickening.

Brown or slate-grey above with small, irregular, scattered, red spots more or

less bordered by black. Belly and throat with moderately large dark brown spots, the ground-colour white, suffused with bluish anteriorly and pink posteriorly. Hind limbs marbled with black or brown and pink; a deep pink spot in the axilla and groin, outlined or marbled with black. Throat of the male less spotted than that of the female and coloured bright yellow.

Male with a vocal sac opening by a slit on each side of the tongue.

Length from snout to vent : ♂ 31 mm. ; ♀ 33 mm.

The species is nocturnal and cryptozoic, frequenting damp localities. Breeding in late summer (March). The song is a short, rasping note repeated several times in a few seconds. Eggs to the number of about 120 in a clutch are laid in cavities underground in low-lying places, or attached to the stems of grasses and rushes a little above ground level, but always in spots liable to be flooded during rain. The developmental period within the egg is probably long (at least five weeks), and the tadpole is hatched in an advanced stage of development, without any trace of external gills (English and Blanchard).

DISTRIBUTION : Tasmania up to 3000 ft.

SPECIMENS EXAMINED.

B.M. 60.11.29.25	♀	Tasmania.	Milligan. TYPE.
70.6.26.23	♀	?	Krefft.
1928.4.25.2	♂	National Park, Tasmania.	Blanchard.
Austr. Mus. R.7597-7600	8 ♀♀	Ulverstone, "	
R.10328	2 ♂♂, juv.	" "	
R.9832	♂	National Park, "	
R.10322	2 ♀♀	Port Arthur, "	
R.10325	♂	Tasmania.	
—	3 ♂♂, ♀	Wilmot, Tasmania.	
R.10352 (part)	♀	Between Port Arthur and Roger River, Tasmania.	

Crinia laevis victoriana Boulenger.

Crinia victoriana Boulenger, 1888, *Ann. Mag. nat. Hist.*, (6), 2 : 142 (Type locality :—Warra-gul, Gippsland, Victoria) ; Lucas & le Souef, 1909, *Anim. Austral.* : 276 ; Nieden, 1923, *Das Tierreich, Anura I* : 543.

Crinia froggatti Fletcher, 1891, *Proc. Linn. Soc. N.S.W.*, (2), 6 : 274, 275 (Type localities :—Buninyong and Gong Gong, near Ballarat) ; *idem*, 1894, *op. cit.*, (2), 8 : 523 ; Lucas & le Souef, 1909, *Anim. Austral.* : 276 ; Blanchard, 1929, *Aust. Zool.*, 5, 4 : 328.

Crinia laevis froggatti Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 29.

? *C(rinia) sp.* Lucas, 1892, *Proc. roy. Soc. Victoria*, 4 : 61.

Crinia laevis (part) Nieden, 1923, *Das Tierreich, Anura I* : 542.

This race is very similar to the typical form in morphological characters and colour, but has a slightly longer hind limb, the tibio-tarsal articulation reaching nearly to the angle of the mouth, and the ventral surfaces are beset with smaller spots and some degree of dark stippling, giving a generally more dusky appearance. Frequently there is a dark triangular, interorbital spot, apex directed posteriorly, which may, or may not, be continuous with two dark, sinuous streaks which run backwards on each side of the middle line towards the groins. The voice of the male is also different, consisting of a series of low rasping notes followed by a series of high-pitched "pips", thus—crrrack, crrrack, crrrack, pip, pip, pip, pip-pip-pip-pip-pip-pip-pip. (Blanchard.)

DISTRIBUTION : Victoria, south of the Dividing Range.

SPECIMENS EXAMINED.

B.M. 88.7.3.13	♀	Warragul, Gippsland, Victoria.	R. T. Baker. TYPE.
92.9.16.6	♀	Ballarat, Victoria.	Froggatt. Cotype of <i>C. froggatti</i> Fletcher.
Austr. Mus. R.9498	♀	Healesville, Victoria.	
R.8338,	5 ♂♂, 4 ♀♀,	Ballarat, Victoria.	COTYPES of <i>C. froggatti</i> Fletcher.
10326	juv.		
R.10350	♂	Panton Hill, Victoria.	
R.8331-6	5 ♂♂, 18 ♀♀,		
R.10332-4	11 juvs.	Warragul, Victoria.	

***Crinia darlingtoni* Loveridge.**

Crinia darlingtoni Loveridge, 1933, *Occ. Pap. Boston Soc. nat. Hist.*, 8 : 57 (Type locality :—3000–4000 ft., Queensland National Park, MacPherson Range, Queensland); *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 29.

Vomerine teeth absent.¹ Snout obtusely rounded, not prominent, 1.3 times as long as the eye; canthus rostralis rounded; loreal region moderately oblique; nostril equidistant from the eye and the tip of the snout; interorbital space 1.5 times as broad as the upper eyelid; tympanum hidden. Fingers very short, the first reduced to a mere stump (without phalanges); the remainder with distinct subarticular tubercles; palm smooth; two large metacarpal tubercles. Toes short, not fringed, the first rudimentary; remainder slightly dilated terminally, with indistinct subarticular tubercles; a small inner, and sometimes traces of an outer, metatarsal tubercle. Tibio-tarsal articulation reaching the shoulder in adults, the eye in juveniles.

Skin perfectly smooth above and below.

Brown or pinkish brown above with traces of a Microhylid type of colour pattern consisting of a dark median band commencing between the upper eyelids and connecting them, narrowing in the scapular region, broadening in the sacral region, narrowing and then finally bifurcating, the two branches running towards the groins where they terminate in darker spots. A vertical dark bar beneath the eye. A lateral dark band from the nostril, through the eye, above the arm and along the flanks. Hind limbs with a single diagonal cross-bar each on the femur, tibia, and tarsus; a dark spot on the knee and a triangular black spot enclosing the vent. Some or all of these markings may become obscure and the dorsal and lateral bands are frequently broken up, the posterior portions being lost before the anterior. Lower surfaces heavily mottled and stippled with brown, except on the belly and thighs.

Length from snout to vent : ♀ 19 mm.

DISTRIBUTION : 3000–4000 ft., Queensland National Park, MacPherson Range.

SPECIMEN EXAMINED.

M.C.Z. 18392	juv.	Type locality.	Darlington.	Paratype.
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***Crinia haswelli* Fletcher.**

Crinia haswelli Fletcher, 1894, *Proc. Linn. Soc. N.S.W.*, 1893. (2), 8 : 522, 526, 530 (Type locality :—near head of Jervis Bay); Nieden, 1923, *Das Tierreich, Anura* 1 : 540.

Epicoracoids very strongly overlapping and extending forwards beyond the

¹ The original description states "mandible toothed," but this is presumed to be a slip, "maxilla" being intended.

clavicles (text-fig. 16). Vomer entire; vomerine teeth present, in short transverse series well behind the level of the internal nares. Snout rounded, 1.2 to 1.5 times as long as the eye, shorter in juveniles than adults, with rounded canthus rostralis and very oblique, convex, loreal region; nostril equidistant from the eye and the end of the snout; tympanum hidden or just perceptible; inter-orbital space 1.1 to 1.2 times as broad as the upper eyelid in females, 1.2 to 1.4 times in males. Fingers slender, free, with well-developed subarticular tubercles; palm smooth; two metacarpal tubercles. Toes slender, fringed; subarticular tubercles well developed; a small inner metatarsal tubercle, but the outer minute or absent; no tarsal fold. Tibio-tarsal articulation reaching the tympanic region.

Skin smooth or with scattered tubercles above; a fold from the posterior corner of the eye above the arm to the middle of the flanks, with a well-marked parotoid gland below it; a circular glandular spot on the flank just in front of the groin. Belly slightly granular, hinder side of the thighs more strongly so; a small pectoral spot close to the insertion of the fore-limb, and a minute papilla on the heel.

Colour in spirit, pale brown, with scattered small darker spots. A dark brown band from the nostril through the eye and below the supra-tympanic fold to the middle of the flanks. Lower surfaces uniform dirty white in juveniles, pale brown in adults with the abdomen covered with large, circular white spots. Groins and concealed surfaces of the limbs dark brown with large white spots. A fine, light, mid-dorsal line may be present. In life, the ground-colour dorsally is chestnut brown, drab, or silver-grey, with an incomplete darker band down the middle, commencing between the eyes; the light spots of the groin and concealed surfaces of the limbs carmine or orange red.

Male with a vocal sac opening by a slit on each side of the tongue and glandular, non-spinous nuptial pads at the base of the two inner fingers and on the inner surface of the forearm.

Length from snout to vent: ♂ 26 mm.; ♀ 32 mm.

DISTRIBUTION: Coastal districts of New South Wales.

SPECIMENS EXAMINED.

Austr. Mus. R.10335	2 ♂♂, ♀, Hgr.	Jervis Bay.	COTYPES.
R.4210,	♂, ♀, 8 juvs.	Maroubra, near Sydney.	
5288, 6132-5			

This species is in many respects intermediate between the smooth-skinned species of the *laevis* group and the granular bellied *signifera-georgiana* group. The peculiar shoulder-girdle, in which the omosternum shows its double origin from the epicoracoids, may be considered primitive, and it is possible that *haswelli* is the most primitive member of the genus.

Crinia georgiana Tschudi.

Crinia georgiana Tschudi, 1838, *Mém. Soc. neuchâtel. Sci. nat.*, **2**: 38, 78 (Type locality:—King George's Sound); Kesterstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18**: 347 (part); *idem*, 1868, *Arch. Naturgesch.*, **34**: 263; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 264; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4**: 375, 387; *idem*, 1898, *op. cit.*, **22**, 1897: 676; Lucas & le Souef, 1909, *Anim. Austral.*: 276; Werner, 1914, *Fauna S.W. Austral.*, **4**: 408; Nieden, 1923, *Das Tierreich, Anura I*: 540; Hoffman, 1931, *S. Afr. J. Sci.*, **28**: 405 (? possibly *C. signifera*); Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 23.

- Cystignathus georgianus* Duméril & Bibron, 1841, *Expét. Gén.*, 8 : 416; Bell, 1843, *Zool. Beagle, Rept.* : 33, pl. 16, fig. 4; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 30; Krefft, 1865, *Pap. roy. Soc. Tasmania* : 16; Krefft, 1867, *Cal. Industr. Prod. N.S.W., Add.* : 107.
- Pterophryne georgiana* Günther, 1867, *Ann. Mag. nat. Hist.*, (3), 20 : 53.
- Crinia ignita* Cope, 1866, *J. Acad. nat. Sci. Philad.*, (2), 6 : 95 (Type locality :—West Australia).
- Crinia signifera ignita* Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 25.
- Pterophrynus affinis* Günther, 1864, *Proc. zool. Soc. Lond.* : 47, pl. 7, fig. 2 (Type locality :—Western Australia); *idem*, 1864, *Ann. Mag. nat. Hist.*, (3), 14 : 312; Krefft, 1865, *Pap. roy. Soc. Tasmania* : 16.
- Crinia affinis* Günther, 1868, *Proc. zool. Soc. Lond.* : 480.
- Crinia georgiana* var. *affinis*, Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 265.
- Crinia affinis affinis* Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 26.
- Crinia stolata* Cope, 1867, *J. Acad. nat. Sci. Philad.*, (2), 6 : 201 (Type locality :—West Australia).
- Crinia georgiana* var. *stolata* Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 264; Fry, 1914, *Rec. N. Aust. Mus.*, 1 : 203, pl. 28, fig. 1.

Vomerine teeth usually present in adults. Snout moderate, rounded, not prominent, 1.14 to 1.35 times as long as the eye (mean of 29 specs. 1.25); canthus rostralis rounded; loreal region oblique; nostril equidistant from the eye and the end of the snout; tympanum usually slightly distinct $\frac{1}{2}$ to $\frac{3}{5}$ the diameter of the eye; interorbital space about once and a quarter as broad as the upper eyelid. Fingers moderately long, free, with well-developed subarticular tubercles; palm tubercular; two metacarpal tubercles. Toes long, without dermal fringes; subarticular tubercles well developed; two metatarsal tubercles and an oblique tarsal fold from the inner. Tibio-tarsal articulation reaching the tympanic region or the posterior corner of the eye.

Skin above from quite smooth to distinctly and irregularly rugose, specimens from the same area showing all intermediate conditions. From a perfectly smooth frog (*affinis*) the next stage is the progressive development of a dorso-lateral fold from behind the upper eyelid (*ignita* or *stolata*); smaller secondary folds may be associated with these and, with the development of ridges and warts elsewhere, the dorso-laterals tend to be broken up. There is always a parotoid-like glandular swelling above and slightly in advance of the arm and a small dermal papilla on the heel. Cloacal flap fimbriated. Lower surfaces coarsely granular; a triangular, finely granular patch on the hinder side of the thighs behind the vent.

As in *C. signifera*, the dorsal colour pattern is associated with the rugosity of the skin. Smooth specimens have the *affinis* colour, uniform, or nearly uniform pale brown above, with a dark brown lateral stripe from the nostril through the eye to the groin, partially interrupted in the parotoid region. Where the skin is warty the warts are each picked out in dark brown, so that in the *ignita* or *stolata* varieties there are two dark longitudinal dorsal stripes separated from each other by a lighter area and from the lateral stripe by an area of grey; a triangular or V-shaped interorbital blotch is also developed and dark markings radiating from the eye on the upper lip. With the breaking up of the dorso-lateral folds and the increased development of warts and folds elsewhere the whole dorsum has a complex, irregular pattern of dark marblings separated by lighter brown or silvery grey. Limbs cross-barred. Armpits, groins and hinder aspect of the knees brilliant carmine, this colour being "fast" in alcohol (traces still present after nearly a century) but fugitive in formalin (destroyed in six months). Lower surfaces of juveniles and half-grown specimens washed with pale brown except for a white median line; the tips of some of the warts and especially a larger, pectoral spot on each side white or rose-tipped. With increasing age the brown

wash tends to become less and less distinct, but the pectoral glandular spots remain a clearer white than the rest of the lower surfaces. Throat of the breeding male infusate.

Male with a vocal sac opening by a slit on each side of the tongue, but without any definite nuptial pad.

Length from snout to vent: ♂♂ 18.5-33.5 (mean of 14 exs. 26.0); ♀♀ 22.6-35.0 (mean of 12 exs. 27.3).

DISTRIBUTION: West Australia.

The localities "Port Essington" and "Sydney" recorded by Boulenger for this species, based on specimens in the British Museum, are very doubtful indeed, and can be neglected unless confirmation is forthcoming—an unlikely event after the lapse of more than half a century.

		SPECIMENS EXAMINED.		
B.M.	R.R.1936.12.3.86	♀	W. Australia.	Dämel. Type of <i>Pterophrynus affinis</i> .
	64.10.27.56-57	2 ♀♀	King George's Sound, W.A.	Krefft.
	85.9.2.20-22	♂, 2 ♀♀	Albany, W.A.	Ling Roth.
	1929.12.11.3	♀	Lefroy River, near Pemberton, W.A.	Nicholls.
	1933.1.1.1-2	Hgr. and juv.	Augusta, W.A.	Brooks.
M.C.Z.	13011-5 (part)	♂	Manjimup, W.A.	"
	18395	♂	Lesmurdie, W.A.	Nicholls.
B.M.	R.R.1936.12.3.85	♂	" Port Essington " (?)	Fleming.
	R.R.1936.12.3.83-84	♂, 2 ♀♀	" " (?)	"
	70.6.26.49-51, 24	♀, 5 Hgr.	?	Krefft.
	45.5.25.26	♀	King George's Sound.	C. Darwin.
	58.8.21.1	♀	?	(Günther.)
	62.8.1.1-8	3 ♂♂, 3 ♀♀, 2 juvs.	" Sydney " (?)	(Stevens.)
Austr. Mus.	R.6758	♂	Cape Leeuwin, W.A.	
	R.6761	♀	" "	
	R.7710	juv.	Tudor, W.A.	
	R.7740	♂	Lucky Bay, 26 miles E. of Esperance, W.A.	
	R.7741	♂	Mississippi Bay, E. of Esperance, W.A.	
	R.7742	imm. ♀	Ditto.	
	R.7746	♂, 2 Hgr., 1 juv.	Below Forts, Albany, W.A.	
	R.9979	♀	Between Carnarvon and N.W. Cape.	
	R.10329	♂	Mt. Barker, W.A.	
	R.10330	2 ♂♂	Como Swamp, Perth, W.A.	
	R.10331	2 ♂♂, ♀	Ditto.	
	R.10462	2 ♂♂	South-west Australia.	
	R.10952	♂	Pemberton, W.A.	
	R.10958	2 juvs.	Manjimup, W.A.	
	R.10968	juv.	Rottnest Island, W.A.	

Like *Crinia signifera* this species exhibits a good deal of variation in colour pattern in correlation with variations in the degree of development of the dorsal warts and folds. The two species parallel one another very closely in these characters, and the variants of each, though forming a continuous series, can be roughly subdivided into three main groups, the smooth, uniform, *affinis* type of pattern, the striped *stolata* or *ignita* pattern with its concomitant longitudinal folds and the irregularly marbled and warty typical form. It seems probable that Loveridge in his recent (1935) consideration of the genus has assigned too

much importance to these characters, and rather neglected the other morphological characters such as vomerine teeth, digital fringes and degree of development of the tympanum which the present author believes to provide a surer index of relationship. As a result Loveridge recognizes no less than five separate forms (out of a potential six), but applies specific and subspecific names to them on the basis of colour and geography. The result is as follows :

Species.	Colour var.	Locality.	Loveridge's name.
<i>C. signifera</i>	Typical	S.E. Australia.	<i>C. signifera signifera</i> .
	" <i>ignita</i> ."	S.E. Australia.	" " " " " "
	" <i>affinis</i> ."	S.E. Australia.	<i>C. affinis haswelli</i> .
<i>C. georgiana</i>	Typical.	W. Australia.	<i>C. georgiana</i> .
	" <i>ignita</i> "	W. Australia.	<i>C. signifera ignita</i> .
	" <i>affinis</i> ."	W. Australia.	<i>C. affinis affinis</i> .

This also leads to some entirely fictitious conclusions (p. 28) as to the development of vomerine teeth in frogs from the south-west of Australia and their absence in eastern " forms " of the same " species." Actually the presence or absence of vomerine teeth appears to be a good specific character and the two species may be distinguished thus :

<i>C. georgiana</i> .	<i>C. signifera</i> .
Vomerine teeth usually present.	Vomerine teeth always absent.
Digital fringes absent.	Digital fringes present in adults.
Tympanum larger and slightly distinct.	Tympanum smaller, not distinct.
Flash colours of carmine strongly developed and fast.	Flash colours of orange or carmine absent or, if present, fugitive.

Crinia glauerti Loveridge.

Crinia glauerti Loveridge, 1933, *Occ. Papers Boston Soc. nat. Hist.*, 8 : 57 (Type locality :—Mundaring Weir, 30 miles N.E. of Perth, West Australia) ; *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 24.

The status of this species is doubtful. In the first place, although it is described as a " miniature replica " of *C. georgiana*, digital fringes are said to be present and vomerine teeth absent—both characters of *signifera* rather than *georgiana*. However, in the two paratypes examined vomerine teeth are present, though few in number, and there are no true digital fringes, but only the lateral seams found in most frogs ; they have the appearance of small examples of *georgiana*, though having been fixed in formalin, it is not possible to say whether the characteristic red on the legs of that species was also present. If the name is applicable to these small, but sexually mature, examples which are so closely allied to *georgiana*, the only differences to be found distinguishing the two are size and the length of the snout. In *signifera* it is found that there is a great range of variation in the size at which sexual maturity is reached, and that this is not wholly connected with locality ; it may conceivably be dependent on the climatic and food conditions prevailing during the larval and post-larval period ; the same state of affairs might well be expected to occur in *georgiana* and, in that event, *glauerti* would fall within the range of size of *georgiana*. There remains

only the length of the snout. In the examples of *glauerti* examined it is 1.35 times as long as the eye; this is equal to the maximum length found (twice) in a series of 29 examples of *georgiana*. Obviously it is necessary to know much more concerning the range of variation of this character in *glauerti* before it can be used with confidence diagnostically.

Vomerine teeth present. Snout pointed, slightly prominent, 1.35 times as long as the eye, with somewhat marked canthus rostralis; nostril equidistant from the eye and the end of the snout; tympanum slightly indicated; interorbital space 1.4 times the width of the upper eyelid. Fingers slender, free, with well-developed subarticular tubercles; palm tubercular; two metacarpal tubercles. Toes long, free, without fringes, but with well-developed subarticular tubercles; two metatarsal tubercles, the inner about $\frac{1}{3}$ its distance from the tip of the inner toe, an oblique tarsal fold from the inner metatarsal tubercle. Tibio-tarsal articulation reaching the tympanic region or the posterior corner of the eye.

Skin somewhat warty with a pair of curved folds, convex towards the midline, on the scapular region. Granular beneath and on the hinder side of the thighs; a pectoral glandular spot close to the insertion of the arms; a small papilla on the heel.

Blackish above (formalin preservation) with traces of a darker pattern, especially an interorbital mark; popliteal region white (? red in life). Lower surfaces dirty white, marbled with black in females; throat of breeding male infusate.

Male with a vocal sac opening by a slit on each side of the tongue; no nuptial pad.

Length from snout to vent: ♂♂ 14.5–15.5 mm.; ♀♀ 20.5 mm.

DISTRIBUTION: Known only from the type locality, near Perth, West Australia.

SPECIMENS EXAMINED.

M.C.Z. 18422	♀	Mundaring Weir, near Perth.	Darlington. (PARATYPE.)
Austr. Mus. 10910	♂	" " " "	Darlington. (PARATYPE.)
Swedish Mus. 1557	♂♀	" " " "	Mjöberg.

Crinia tasmaniensis (Günther).

¹ *Camariolius varius* (part) Peters, 1863, *Mber. Akad. Berlin*: 236.

Pterophrynus tasmaniensis Günther, 1864, *Proc. zool. Soc. Lond.*: 48, pl. 7, fig. 3 (Type locality:—van Diemen's Land); *idem*, 1864, *Ann. Mag. nat. Hist.*, (3), **14**: 313; Krefft, 1865, *Pap. roy. Soc. Tasmania*: 16.

Crinia tasmaniensis Keferstein, 1868, *Arch. Naturgesch.*: 265; Günther, 1868, *Proc. zool. Soc. Lond.*: 480; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 266; Lucas & le Souef, 1909, *Anim. Austral.*: 276; Nieden, 1923, *Das Tierreich*, Anura I: 541, fig. 373; Blanchard, 1929, *Aust. Zool.*, **5**, 4: 324; Loveridge, 1934, *Pap. Proc. roy. Soc. Tasmania*, 1933: 60; *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 28.

Camariolius (Pterophrynus) tasmaniensis (?) Parker, 1881, *Phil. Trans. roy. Soc. Lond.*, **3**: 102, pl. 19, figs. 1–5.

Vomerine teeth vestigial or, usually, absent. Snout depressed, not prominent, 1.3 to 1.5 times as long as the eye; canthus rostralis rounded; loreal region very oblique; nostril a little nearer the eye than the end of the snout; tympanum indistinct; interorbital space 1.2 to 1.4 times as broad as the upper eyelid. Fingers moderate, free, with well-developed subarticular tubercles; palm tubercular; two metacarpal tubercles. Toes long, with well-marked dermal fringes;

¹ See p. 89 below.

subarticular tubercles well developed; two metatarsal tubercles; no tarsal fold. Tibio-tarsal articulation reaching the shoulder or tympanum in adult females and from the latter point to the eye in males and juveniles.

Skin smooth or with more or less distinct plicae and small warts dorsally; glandular but smooth or feebly granular ventrally except behind the thighs, which are strongly granular. Indications of a minute papilla on the heel; a parotoid glandular thickening.

Dark brown, grey or olive above, with darker longitudinal stripes or spots. Usually a lateral stripe from the nostril through the eye, interrupted above the arm, and a pair of dorso-lateral stripes separated from the laterals by a light brown, orange or even reddish stripe; a dark, triangular or V-shaped inter-orbital spot and a vertical dark bar beneath the eye. Lower surfaces brown or blackish, marbled with white anteriorly and with white or bright red spots and blotches posteriorly and on the limbs; the extent of each colour is variable, so that the belly may appear light with dark vermiculations; a pair of pectoral glandular spots also red. This red pigment is fast in alcohol (persistent after 80 years) but destroyed by formalin. Gular region of the male almost completely black.

Male with a vocal sac opening by a slit on each side of the tongue and a glandular, not rugose, nuptial pad at the base of the inner digit, not extending appreciably on to the forearm.

Length from snout to vent: ♂ 24 mm.; ♀ 30 mm. Juveniles at metamorphosis: 9-10 mm.

The species is apparently strictly aquatic. Breeding season extended in the summer months; sexual maturity reached at the end of the second season after metamorphosis. Eggs 46 to 69 in a clutch (Blanchard, 1929).

DISTRIBUTION: Tasmania at relatively high altitudes (2500-4000 ft.).

SPECIMENS EXAMINED.

B.M. 58.11.25.63	3 ♂♂, 2 ♀♀, 2 juvs.	Tasmania.	COTYPES.
1928.4.25.1	♀	National Park, Tasmania.	Blanchard.
1936.12.2.3-7	1 ♂, 4 ♀♀	Cradle Valley, Tasmania.	"
1936.12.2.8	♀ skel.	"	"
Austr. Mus. R.4400-4401, 1 5087	2 ♂♂, juv.	Summit of Mt. Wellington, Tas- mania.	
R.10337, 10349	3 ♂♂, ♀	The Spring, Mt. Wellington, Tasmania.	
R.10336	♀	Tasmania.	
R.10339-10340	♂, 3 ♀♀	Cradle Valley, Tasmania.	"
R.10338	♂	Ulverstone, Tasmania.	
R.10341, 10342, 1 10345, 10347	4 ♂♂, ♀	National Park, c. 4000 ft., Tas- mania.	"
R.10343, 10344, 1 10346, 10348	5 ♂♂, 2 ♀♀, juv.	Lake Fenton, National Park, Tasmania.	"
R.10074	♂♀	Mt. Wellington, Tasmania.	
R.10352	♂♀	Between Port Arthur and Roger's River, Tasmania.	

Crinia acutirostris Andersson.

Crinia acutirostris Andersson, 1916, *Svenska Vetensk.Akad. Handl.*, 52, 9: 8, pl. 1, fig. 2 (Type locality:—Malanda, Queensland); Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 30.

Vomerine teeth absent. Snout truncate, not projecting beyond the labial margin, once and a quarter as long as the eye; canthus rostralis angular; loreal

region nearly vertical; nostril equidistant from the eye and the end of the snout, interorbital space a little broader than the upper eyelid; tympanum slightly distinct, a little less than half the diameter of the eye. Fingers free, with well-developed subarticular tubercles; palm smooth; two metacarpal tubercles. Toes long, slightly dilated terminally, with well-marked dermal fringes; subarticular tubercles moderate; a single, inner metatarsal tubercle; a tarsal fold present or absent. Tibio-tarsal articulation reaching the eye.

Skin quite smooth or granular and tuberculate with spinose warts in breeding males, these spines forming series on each side of the vent and on the hind limbs, with a pair on the back behind the eyes and others forming a triangle on the posterior part of the back; sometimes a narrow glandular fold from the eye to the groin. Smooth beneath. Sometimes a papilla on the heel.

Grey-brown above, uniform or with a darker, triangular, interorbital marking and some smaller dark spots on the posterior part of the back; a dark lateral band from the nostril to the groin, sometimes narrowly light-edged above; two light bars on the lip beneath the eye; groins yellow or red; limbs cross-barred; lower surfaces white (reddish-yellow in life), with a reticulate brown stippling; throat of the male infuscate.

Male with a vocal sac opening by a slit on each side of the tongue.

Length from snout to vent: ♂ 23 mm.; ♀ 30 mm.

DISTRIBUTION: Queensland.

SPECIMENS EXAMINED.

M.C.Z. 18416	♀	Mt. Spurgeon, Q.	Darlington.
B.M. 1938.7.2.1	♂	Mundubbera, Q.	Sherrin.

Crinia signifera Girard.

Crinia (*Ranidella*) *signifera* Girard, 1853, *Proc. Acad. nat. Sci. Philad.*: 422 (Type locality:—New Holland); Cope, 1867, *J. Acad. nat. Sci. Philad.*, (2), 6: 203.

Ranidella signifera Girard, 1858, *U.S. Explor. Exped., Herp.*: 44, pl. 3, figs. 39–43.

Crinia signifera Boulenger, 1882, *Cat. Batr. Brit. Mus.*, ed. 2: 265; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), 4: 375; *idem*, 1891, *op. cit.*, (2), 6: 272–274; *idem*, 1892, *op. cit.*, (2) 7: 8, 9; Lucas, 1892, *Proc. roy. Soc. Victoria*, 4: 61; Fletcher, 1894, *Proc. Linn. Soc. N.S.W.*, (2), 8: 526, 527, 528, 530; *idem*, 1898, *op. cit.*, 22, 1897: 676; Lucas & le Souef, 1909, *Anim. Austral.*: 275, fig.; English, 1910, *Proc. zool. Soc. Lond.*: 629, pl. 51, figs. 4, 5; Werner, 1914, *Fauna S.W. Austral.*: 411; Andersson, 1913, *K. Svenska Vetensk. Akad. Handl.*, 52, 4: 12, pl. 1, fig. 1; Roux, 1920, *Rev. suisse Zool.*, 28: 115; Nieden, 1923, *Das Tierreich, Anura I*: 541; van Kampen, 1923, *Amph. Indo-Austral. Archip.*: 21; Blanchard, 1929, *Aust. Zool.*, 5, 4: 326; Waite, 1929, *Rept. Amph. S. Austral.*: 257; Glauert, 1929, *J. roy. Soc. W. Austral.*, 15: 45; Trewavas, 1933, *Phil. Trans. roy. Soc. Lond.*, 222, B: 436, figs. 26, 27.

Crinia signifera signifera Loveridge, 1934, *Pap. roy. Soc. Tasmania*, 1933: 59; Oeser, 1934, *Bl. Aquar.-u. Terrarienk.*, 45: 355; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 24.

Pseudophryne australis (part) Fitzinger, 1861, *S.B. Akad. wiss. Wien*, 42: 415.

Pterophryne verrucosus Lutken, 1862, *Vidensk. Medd. naturh. Foren. Kbh.*: 302, pl. 1, fig. 4 (Type locality:—Australia).

Crinia verrucosa Günther, 1868, *Proc. zool. Soc. Lond.*: 478.

? *Camariolius varius* Peters, 1863, *Mber. Akad. Berlin*: 236 (Type locality:—near Adelaide).

Pterophryne varius Steindachner, 1867, *Reise Novara, Zool., Amph.*: 31, pl. 2, figs. 1–6; Krefft, 1867, *Cat. Industr. Prod. N.S.W.*, Add.: 107.

Crinia georgiana var. *varia* Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, 18: 349.

Crinia varia Keferstein, 1868, *Arch. Naturgesch.*, 34: 264, pl. 6, figs. 11–13.

Crinia stictiventris Cope, 1867, *J. Acad. nat. Sci. Philad.*, (2), 6: 203 (Type locality:—Australia).

Pterophryne fasciatus Steindachner, 1867, *Reise Novara, Zool., Amph.*: 31, pl. 5, figs. 3, 4 (Type locality:—New South Wales).

Pterophryne fasciata Günther, 1867, *Ann. Mag. nat. Hist.*, (3), 20: 53.

Crinia fasciata Günther, 1868, *Proc. zool. Soc. Lond.*: 478.

Crinia georgiana var. *laevipes* Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 348 (Type locality :—Sydney).

Cystignathus sydneyensis Krefft (nom. nud.), Keferstein, 1867, *loc. cit.*

Crinia affinis haswelli (non Fletcher) Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 27.

Crinia georgiana (part) Loveridge, 1935, *tom. cit.* : 23.

Pseudophryne semimarmorata (non Lucas) Loveridge, 1935, *tom. cit.* : 34.

This species exhibits a great deal of variation both in morphological characters and colour-pattern. The latter is believed to have little taxonomic significance, but at least two apparently distinct geographical races appear to be recognizable, in addition to the typical form, as indicated in the key. None of the existing names are obviously applicable to either of these forms, and it will lead to less confusion to give them new names, which may subsequently have to be placed in synonymy, rather than to use, incorrectly, ones which already exist.

Crinia signifera signifera (Girard).

Vomerine teeth absent. Snout short, rounded, not prominent, 1.1 to 1.4 times as long as the eye; canthus rostralis rounded; loreal region oblique; nostril equidistant from the eye and the end of the snout, the internarial space less than, or equal to the distance from eye to nostril; tympanum hidden; inter-orbital space about 1.3 times the width of the upper eyelid. Fingers moderately long, free, with well-developed subarticular tubercles; palm tubercular; two



TEXT-FIG. 19.—Hand of *Crinia signifera*. $\times 9$.

metacarpal tubercles. Toes long, almost always with well-developed dermal fringes in adults, though these may be only feebly developed or absent in juveniles (see table of dimensions below); subarticular tubercles well developed; two metatarsal tubercles, the outer not, or scarcely, more than $\frac{1}{3}$ its distance from the tip of the inner toe and an oblique tarsal fold from the inner. Tibio-tarsal articulation reaching the tympanic region or the eye in males and the shoulder or tympanum in females.

Skin above quite smooth to distinctly and irregularly warty; a complete transition can be traced in specimens from the same region between these extremes,

with an intermediate stage with two strong folds down the back commencing behind the upper eyelids and slightly convergent on the scapular region ; with the development of additional warts elsewhere these folds may be broken up, though usually traces of them persist ; a more or less distinct glandular aggregation above the insertion of the fore-limb. Belly and gular region coarsely granular ; a definite area finely granular below the vent on the hinder side of the thighs. A small papilla on the heel. Cloacal flap fimbriated.

The colour pattern is intimately connected with the degree of wartiness of the skin. Smooth specimens are almost uniform brown above, with a dark lateral stripe from the nostril through the eye, interrupted behind the tympanic region and continued along the flanks to the groin ; lips with dark bars irregularly radiating from the eye ; usually there is an indistinct triangular marking between the eyes, and a fine white line from snout to vent. With the development of warts, each tends to be light in the centre, edged with darker ; in consequence, where there are two well-developed dorsal folds a striped pattern is developed, the centre of each fold forming a narrow light line bordered on each side by darker, these darker areas being in turn separated from each other in the middle and from the lateral stripe by broader light zones, which may be marked with very narrow dark streaks. Where the dorsum is irregularly warty all over, a pattern of obscure irregular darker marblings ensues. Limbs with diagonal cross-bars. Anal flap invariably with a light dot. Lower surfaces more or less profusely brown spotted, these markings attaining their maximum development in specimens from New South Wales which have the colours almost reversed, i.e. are brown with large white spots. There is constantly a pair of small white, glandular pectoral spots, one close to the insertion of each fore-limb. Gular region of male plicate and infusate, but the edge of the jaw lighter. In life the colours are browns and greys above, but there may be suffusions of yellow, orange or carmine on the concealed surfaces of the limbs and flanks, these colours being fugitive in alcohol.

Male with a vocal sac opening by a slit on each side of the tongue, and in the breeding season, a non-spinous glandular area on the base of the inner finger and distal half of the inner surface of the forearm.

Length from snout to vent, maxima : ♂ 25 mm. ; ♀ 30 mm. Juveniles at metamorphosis : 6·7–10 mm.

There is some geographical variation in size with latitude, and in the size at which maturity is attained, and digital fringes developed. This may be summarized as follows :

Locality.	No.	Length ♂.	Mean.	Length ♀.	Mean.	Minimum with fringes.	Maximum without fringes.
Queensland and North. Terr.	14	15·5–18·5	16·9	17–19	18·3	15·5	17
West. Austr.	57	11·5–24	18·4	17–26	21·1	11·5	20
N.S.W.	38	17·2–20	18·7	17·3–26·5	21·5	17·2	18·5
S. Austr.	32	18·5–25	21·2	19–30	26·0	18·3	19·3

On Kangaroo Island there may be a distinct race, recognizable by even larger size and suppression of the digital fringes ; unfortunately the series examined is somewhat shrivelled, so that the latter character cannot be satisfactorily determined. Females of 23 mm. do not appear to be fully mature and have only rudimentary digital fringes.

The species is largely aquatic, with a considerable tolerance of differing conditions from mountain streams to shallow, muddy pools. Breeding occurs throughout the year after rain in New South Wales and South Australia. The note of the males is an insect-like chirrup, embrace lumbar; eggs to the number of about 150 are laid in masses attached to objects at the bottom of the water; individual eggs are about 1.3 mm. in diameter, with a jelly-capsule of 4 mm. in diameter. Hatching takes place in about ten days after oviposition, and the tadpole stage is prolonged (estimated as three months by Harrison, 1922 : 31).

DISTRIBUTION: New South Wales, Victoria (?), South Australia, West Australia, Queensland and Northern Territories; New Guinea (Merauke).

SPECIMENS EXAMINED.

B.M.	43.5.19.75	♀	W. Australia.	(Turner.)
	45.5.25.25	♂, 2 ♀♀	" Australia."	Charles Darwin.
	44.10.17.20	♂	"	Earl of Derby.
	64.10.27.42-44	3 ♀♀	Sydney.	Kreffit.
	64.7.8.5-7	4 ♀♀	"	"
	62.8.1.1-8 (part)	♀	"	Stevens.
	60.6.16.39	♀	"	(Cuming.)
	70.6.26.22 (part)	♀	Port Macquarie, N.S.W.	Kreffit.
	1936.7.15.4	juv.	Dorrigo, N.S.W.	Heron.
	1937.7.22.41	♂	Como, near Perth.	Nicholls.
	1937.10.2.1-4	2 ♂♂, 2 ♀♀	Near Perth.	Mjöberg.
	1923.11.11.4-5	2 ♀♀	Bukalowie Cave, near Carrieton, S.A.	Wood Jones.
	1923.11.11.3	Hgr.	W. Kangaroo Island, S.A.	"
M.C.Z.	19586	♀	Third Creek, Magill, S.A.	Tepper.
B.M.	1931.7.1.61-71	5 ♂♂, 6 ♀♀	Baldwin's Lake, north of Mt. Toolbrunup, Albany, W.A.	Baldwin.
	1931.7.1.49-60	12 juvs.	Ditto.	"
	—	♀, Hgr.	Abrolhos.	(Günther.)
Mus. Basel	3180	♀	Merauke, N. Guinea.	Wirz.
Mus. Leiden	2253	♀	New Holland.	Perron & Lesueur.
" "	4238	♂	Sydney.	(Godeffroy Mus.)
Swedish Mus.	1552	13 ♂♂, 9 ♀♀,	Near Perth.	Mjöberg.
	(part)	5 juvs.		
	1559	♀	Yandina, S.E. Queensland.	"
	1559	2 ♂♂, 2 juvs.	Adelaide, S.A.	"
	1553	2 ♂♂, ♀	FitzRoy River, Kimberley Divn., W.A.	"
	1554-	9 ♂♂, 4 juvs.,	St. George's Range, Kimberley Divn., W.A.	"
	1556	larvae		
Austr. Mus.	R.6757	♀	Pallingup River, N. of Cape Riche, W.A.	
	R.7536	2 ♂♂, ♀	Newcastle, W.A.	
	R.7694	2 juvs.	Albany, W.A.	
	R.7701	♀	"	
	R.7704	11 juvs.	Bornham, W.A.	
	R.7708-	♀, 2 juvs.	Tudor, W.A.	
	7709,			
	7711			
	R.7746	♀	Below Forts, Albany, W.A.	
	(part)			
	R. 8415	2 ♂♂, 4 ♀♀,	Donnybrook, Mt. Barker, W.A.	
		4 juvs.		
	R.9980	♀	Between Carnarvon and N.W. Cape, W.A.	
	R.10323	♂, 4 ♀♀	Perth, W.A.	
	R.10331	♀	Como Swamp, Perth, W.A.	
	(part)			
	R.10969	♀, juv.	Manjimup, W.A.	
	R.10084	♂	Night Cliff, Port Darwin, N. Terr.	

Austr. Mus. R.7413	7 ♂♂, 3 ♀♀	Waroo, Inglewood, 60 miles W. of Stanthorpe, Q.
R.8636	♂, 2 ♀♀	Isis Scrub.
— 6953	♀	New South Wales.
— 6965	♀	Sydney, N.S.W.
A.2879	imm. ♂	Smithfield, near Sydney, N.S.W.
R.204	2 ♂♂, ♀	Kangaroo Valley, N.S.W.
R.4109	♂	Lindfield, near Sydney, N.S.W.
R.4209	5 ♀♀	Maroubra, near Sydney, N.S.W.
R.4250	4 ♀♀	Warrell Creek, Nambucca River, N.S.W.
R.4327-9	10 ♂♂	Lindfield, near Sydney, N.S.W.
R.4352	♂	Woodford, Blue Mts., N.S.W.
R.4364	♂	Lindfield, N.S.W.
R.4370	♂, 2 ♀♀	Bundanoon, N.S.W.
R.4397-9	6 ♂♂, 2 ♀♀	Lindfield, N.S.W.
R.4628-9	♂, ♀, 8 Hgr.	Warrell Creek, Nambucca River, N.S.W.
R.4764	2 ♀♀	Tamworth, N.S.W.
R.5210	2 ♂♂, 2 ♀♀	Megalong Valley, Blue Mts., N.S.W.
R.5888-5892	4 ♂♂, 9 ♀♀, 3 juvs.	Gurravembi, near Macks-ville, Nambucca River, N.S.W.
R.6304-6	4 ♂♂, 5 ♀♀, 5 juvs.	Ditto.
R.6490	2 ♂♂, ♀	Tweed River, N.S.W.
R.6496-8	4 ♀♀	Wilde's Meadow, Moss Vale, N.S.W.
R.6500	♂♀	Avoca, near Gosford, N.S.W.
R.7328	3 ♂♂, ♀	Bungendore, 2290 ft., N.S.W.
R.7378-7380	10 ♀♀	Burrawang, 2000 ft., N.S.W.
R.7397 (part)	2 ♂♂, ♀	Yass, N.S.W.
R.7977	♂	Upper Colo, via Richmond, N.S.W.
R.8085	♀, juv.	Maroubra, Sydney, N.S.W.
R.8242	4 ♂♂, 4 ♀♀	Longueville, near Sydney, N.S.W.
R.8303, 8321	8 ♂♂, 4 ♀♀, 2 juvs.	Maroubra, near Sydney, N.S.W.
R.8487	4 Hgr.	Wilde's Meadow, Moss Vale, N.S.W.
R.8490	11 ♂♂, ♀♀ and juvs.	Tweed River, N.S.W.
R.8497	3 ♀♀	Wilde's Meadow, Moss Vale, N.S.W.
R.8502	♂	Avoca, N.S.W.
R.8638 (part)	♀	Bundanoon, N.S.W.
R.8725	♀	Northwood, near Sydney, N.S.W.
R.8765	2 ♂♂, 3 juvs.	Long Bay Rifle Range, Sydney, N.S.W.
R.9835	juv.	Rose Bay, Sydney, N.S.W.
R.10352	♂, 2 ♀♀	Mosman, Sydney, N.S.W.

Austr. Mus. R.10530	♀	Mt. Keira, 1100 ft., N.S.W.
R.10562	7♂♂, juv.	Maroubra, Sydney, N.S.W.
R.11383	2 ♀♀	Comboyne, N.S.W.
R.11868	♀	Cooper's Creek, Huon- brook, N.S.W.
—	46 ♂♂, ♀♀ juvs.	Adelaide, S.A.
R.7168	2 ♂♂, 5 ♀♀	Port Lincoln, Eyre's Penin- sula, S.A.
R.7127	♂, 4 ♀♀, juv.	Birchmore Lagoon, Kan- garoo Island, S.A.
R.7132-3	♂, 3 ♀♀, 3 juvs.	Ditto.
R.7151	2 ♂♂, 4 ♀♀	Timber Creek, Kangaroo Island, S.A.
R.7161	♀, 5 juvs.	Deep Creek, Kangaroo Island, S.A.

The specimens referred to *haswelli* by Loveridge (1935:27) have no vomerine teeth, and, to judge from the specimen examined (19586), no red on the limbs; they appear to be normal smooth-skinned *signifera* with which several of them had previously been associated in the collections of the M.C.Z.

The colour pattern of *signifera* is extremely variable, and is paralleled by that of its congener *C. georgiana*; an almost exactly similar series of colour variations in a single species is exhibited by the S. American *Physalaemus cuvieri* Fitzinger. *Camariolius varius* Peters 1863 is included in the synonymy of this species, although, as Cope (1867:203) and Boulenger (1882:266) pointed out, Peters may have had two species confounded; in the description of *varius* based on six specimens, five from Adelaide and one from an unknown source, the belly is said to be granular or smooth. The specimens from Adelaide are almost certain to be *signifera*, but the other, if it had a smooth venter, may be *tasmaniensis*. Should this prove to be so, Cope's restriction of the name *varius* for the smooth-bellied form must stand and the name would have priority over *tasmaniensis* (1864).

Crinia signifera englishi subsp. n.

Vomerine teeth absent. Snout short, somewhat pointed to slightly prominent, with obtuse canthus rostralis and very oblique lores, 1.2 to 1.5 times as long as the eye; nostril equidistant from the tip of the snout and the eye, or a little nearer the latter; internarial space as long as, or slightly longer than, the distance from eye to nostril; interorbital space 1.25 to 1.5 times as wide as the upper eyelid. Fingers moderate, free, with well-developed subarticular tubercles; palm tubercular; two metacarpal tubercles. Toes moderate, with well-developed dermal fringes in adults; subarticular tubercles well developed; two metatarsal tubercles, the outer approximately half as long as its distance from the tip of the inner toe, and an oblique tarsal fold from the inner. Length of the foot contained 1.84 to 2.23 times in the length from snout to vent (mean of 32 specimens 2.01). Tibio-tarsal articulation reaching the tympanic region.

Skin with small scattered warts above and usually with a more or less continuous, dorso-lateral, linear row on each side of the back; a glandular aggregation in the parotoid region. Lower surfaces and hinder side of the thighs granular. A small papilla on the heel. Cloacal flap fimbriated.

Brown or greyish above, almost uniform sometimes, but usually with more or less distinct traces of some or all of the following darker brown markings.

A triangular interorbital spot, the apex directed posteriorly; a dark dorso-lateral stripe on the dorsolateral line of warts; a canthal stripe continued behind the eye as a temporal spot and a lateral stripe from above the fore-limb to the groin. Lower surfaces yellowish white, mottled with brown; a white, glandular pectoral spot close to the insertion of the fore-limb. Anal flap lighter. Throat of the male infuscate. In life the ground-colour dorsally is dark brown or grey as a rule, males tending to be darker than females, and sometimes almost black. There may be markings of bright orange and the hinder side of the thighs may be washed with blood-red, though this colour is fugitive; tadpoles and juveniles black.

Male with a vocal sac opening by a slit on each side of the tongue and a glandular, non-spinous nuptial pad on the inner finger and distal half of the forearm.

Length: ♂♂ 18.8–24.5 mm. (mean of 18, 22.2 mm.); ♀♀ 21.5–30.0 mm. (mean of 13, 24.9 mm.).

Largely aquatic with a wide tolerance, but very active on land. Call of the male a cricket-like chirp; breeding season chiefly from May to August; eggs laid in masses spread over stones and weeds at the bottom of shallow water. Apparently does not hibernate (English).

DISTRIBUTION: Tasmania.

COTYPES EXAMINED.

B.M. 1901.9.13.10-19	9 ♂♂, 10 ♀♀	Near Launceston.	English.
1936.9.7.4-7	4 ♂♂	Near Devonport.	"
Austr. Mus. 6041-5	5 ♂♂, 2 ♀♀	Launceston.	
10353	♀	Eagle Hawk Neck.	Blanchard.
10356-7	2 ♂♂, 4 ♀♀	National Park.	"
7601	♂♀	Ulverstone.	
Macleay Mus. —	3 ♂♂, 4 ♀♀	George's Bay.	

Crinia signifera montana subsp. n.

Vomerine teeth absent. Snout short, bluntly rounded, not prominent, with obtuse canthus rostralis and very oblique lores, 1.2 to 1.5 times (mean of 31, 1.34) times the length of the eye; nostril a little nearer the eye than the end of the snout; internarial space longer than the distance from eye to nostril; interorbital space 1.2 to 1.5 times the width of the upper eyelid. Fingers moderate, free, with well-developed subarticular tubercles; palm tubercular; two metacarpal tubercles. Toes with short, fleshy fringes in adults; subarticular tubercles well developed; two metatarsal tubercles, the inner about half as long as its distance from the tip of the inner toe; an oblique tarsal fold from the inner. Length of foot contained 1.9–2.35 (mean of 32, 2.12) times in the length from snout to vent. Tibio-tarsal articulation reaching the shoulder.

Skin very warty above, the warts tending to form longitudinal ridges, of which the most constant are an irregular dorso-lateral pair; a glandular parotoid aggregation behind the tympanic region. Lower surfaces and hinder side of thighs granular. A small papilla on the heel. Cloacal flap fimbriated.

Colour pattern and secondary sex characters essentially similar to those of *englishi*.

Length: ♂♂ 19.5–23.7 mm. (mean of 15, 21.8 mm.); ♀♀ 20.5–28.5 mm. (mean of 16, 24.5 mm.).

DISTRIBUTION: Mt. Kosciusko.

COTYPES EXAMINED.

Austr. Mus. 4647	♀, juv.	Mt. Kosciusko, 5000 ft.
579	♀	" " 5500 ft.
5043-4	♂, 3 ♀♀	" " 7000 ft.
5046-8	♂, 2 ♀♀	
5050-3	4 ♂♂, ♀	
7439	6 ♂♂, 4 ♀♀, 2 juvs.	Pretty Point, Mt. Kosciusko.
9741, 9743	♂, 3 ♀♀	Lake Cootapatamba, Mt. Kosciusko, 6500 ft.
9742	♂♀	Rawson Pass, Mt. Kosciusko, 8800 ft.

MYOBATRACHUS.

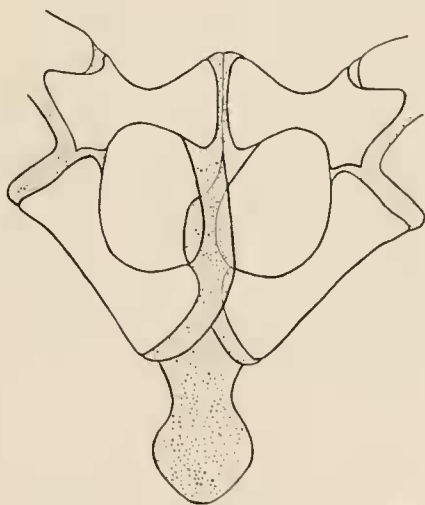
Breviceps (non Merrem) Gray, 1841, in Grey, *Journ. Exped. W. Austral.*, 11 : 448.

Myobatrachus Schlegel, 1850, *Proc. zool. Soc. Lond.* : 9 (Type species :—*M. paradoxus*) ; *idem*, 1851, *Ann. Mag. nat. Hist.*, (2), 7 : 70 ; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 3 ; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 328 ; Cope, 1889, *Bull. U.S. nat. Mus.*, 34 : 259 ; Nieden, 1923, *Das Tierreich, Anura* 1 : 167 ; Noble, 1931, *Biol. Amph.* : 498.

Myiobatrachus Schlegel, 1858, *Handleid. Dierk.*, 2 : 59, 545.

Chelydobatrachus Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 53 (Type species :—*Breviceps gouldii* Gray) ; Cope, 1865, *Nat. Hist. Rev.*, n.s., 5 : 102.

Maxillary teeth absent. No prevomer ; a large fronto-parietal foramen ; quadrato-jugal short, not reaching the maxilla ; ear fully developed, with a very large, thick, extrapleural cartilage, covering the whole of the tympanum. Vertebrae procoelous, with the condyle incompletely ankylosed and notochord



TEXT-FIG. 20.—Ventral elements of the shoulder girdle of *Myobatrachus gouldii*.

persistent ; eight presacrals ; sacral diapophyses broadly dilated ; coccyx articulating by two condyles. No omosternum ; clavicles short and stout, widely dilated mesially ; epicoracoids meeting edge to edge for a third of their length anteriorly and so approaching an arcifero-firmisternal condition ; coracoids directed obliquely backwards ; sternum small, cartilaginous or calcified (text-fig. 20).

Terminal phalanges simple. Distal tendon of the m. semitendinosus passing deep (dorsal) to the m. gracilis. Alary processes of the hyoid, broad wing-like expansions of almost the whole lateral margins of the hyoid plate.

Pupil horizontal with a ventral angle. Tongue small, oval, partly free behind. Digits not dilated distally.

Myobatrachus gouldii (Gray).

- Breviceps gouldi* Gray, 1841 (April), *Ann. Mag. nat. Hist.*, 7 : 89 (Type locality :—Western Australia); Gray, 1841, in Grey, *Journ. Exped. W. Austral.* II : 436, 448, pl. 1, fig. 1.
Myobatrachus gouldii Gray, 1850, *Proc. zool. Soc. Lond.* : 10; *idem*, 1851, *Ann. Mag. nat. Hist.*, (2), 7 : 70; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 329; Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, 22, 1897 : 680, 682; Lucas & le Souef, 1909, *Anim. Austral.* : 288; Werner, 1914, *Fauna S.W. Austral.*, 4 : 421; Fry, 1914, *Rec. W. Aust. Mus.*, 1 : 208; Alexander, 1922, *J. Linn. Soc. Lond. (Zool.)*, 34 : 462; Nieden, 1923, *Das Tierreich, Anura I* : 167, fig. 216; Harrison, 1927, *Rec. Aust. Mus.*, 15 : 287; Kinghorn, 1932, *Rec. Aust. Mus.*, 18 : 361; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 37.
Chelydobatrachus gouldii Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 53, 138; Kreffit, 1865, *Pap. roy. Soc. Tasmania* : 17.
Breviceps Heliogabali Gray, 1841, in Grey, *Journ. Exped. W. Austral.*, II : pl. 1, fig. 1, caption.
Myobatrachus paradoxus Schlegel, 1850, *Proc. zool. Soc. Lond.* : 9 (Type locality :—Swan River, W.A.); Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 3, 128; Kreffit, 1865, *Pap. roy. Soc. Tasmania* : 16; Peters, 1867, *Mber. Akad. Berlin* : 37.
Myobatrachus paradoxus Schlegel, 1858, *Handleid. Dierk.*, 2 : 59, 545, pl. 4, fig. 76.

Habitus globose. Head small, as long as broad, its length contained 4·6 times in the length from snout to vent. Snout bluntly rounded, 1·7 times as long as the eye; nostrils terminal, directed forwards; canthus rostralis rounded; loreal region oblique; interorbital space twice as broad as an upper eyelid; crown of the head dome-shaped owing to the presence of a pad of fibro-glandular thickened skin; tympanum hidden. Limbs very short and stout. Fingers short, stout, depressed, the first shorter than the second; fourth very short (the phalanges reduced to small nodules) but very stout, due to the skin being thickened and somewhat cornified; a tract of similarly thickened skin extends along the outer side of the forearm for a short distance; subarticular tubercles indicated on the proximal joints of the first three fingers; an indefinite outer, but no inner, metacarpal tubercle. Toes very short, free, depressed, the outermost stoutest; traces of subarticular tubercles on the proximal joints only; an extensive, but indistinct, outer metatarsal tubercle, the inner small and only faintly indicated. The total length of the hind limb (vent to tip of fourth toe) about $\frac{2}{3}$ the length from snout to vent.

Skin shagreened and porous above, but not glandular; similar beneath or slightly warty on the abdomen.

Dull brown above, sometimes with faint, ill-defined darker and lighter areas and small pink dots; the cornified skin of the crown of the head and on the outer fingers and forearm yellow or rusty brown; a fine light vertebral line may be present. Dirty white beneath, uniform or dotted with dark brown.

Length from snout to vent : ♂ 44 mm.; ♀ 57 mm.

A cryptozoic species frequenting termites' nests. Male with a vocal sac and, at the breeding season (?), with numerous small, horny spinules very numerous on the dorsal surfaces, larger and more scattered beneath. Eggs very large, ovarian follicles 4 to 4·5 mm. in diameter.

DISTRIBUTION : West Australia.

SPECIMENS EXAMINED.

B.M. 41 (2) 216	♀	W. Australia.	Gould. TYPE.
65.5.4.134-5	♂♂	Swan River.	(Sir A. Smith.)
58.11.25.2	♂	" "	" "
44.7.9.33	♂	Houtman's Abrolhos.	Gould.
1929.12.11.4-5	♂♂	Crawley, near Perth.	Nicholls.
1931.7.1.1	imm.	Mt. Toolbrunup.	Baldwin.
Mus. Leiden 2068	imm. (bad state)	S.W. Australia.	Preiss. (Type of <i>Myobatrachus paradoxus</i> .)

METRACRINIA gen. nov.

Type species: *Pseudophryne nichollsi* Harrison.

Pseudophryne (part) Harrison, 1927, *Rec. Aust. Mus.*, **15**: 285; Barbour & Loveridge, 1929, *Copeia*, **170**: 12; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 35.

Maxillary teeth absent. Prevomer represented by a minute narrow, non-dentigerous bone bordering the antero-mesial edge of each choana; a very large fronto-parietal foramen. Ear fully developed. Vertebrae procoelous, the condyle incompletely ankylosed; notochord persistent; sacral diapophyses broadly dilated; urostyle articulating by two condyles¹; eight presacral vertebrae. Omosternum rudimentary; sternum undivided, cartilaginous; procoracoids very broad. Terminal phalanges simple.

Distal tendon of the m. semitendinosus passing dorsal to the m. gracilis. Alary process of the hyoid a wing-like expansion of almost the whole lateral border of the hyoid plate.

Pupil horizontal with a ventral angle. Tongue narrow, oval, half free behind. Toes free and not dilated distally.

Metacrinia nichollsi (Harrison).

Pseudophryne nichollsi Harrison, 1927, *Rec. Aust. Mus.*, **15**: 284 (Type locality:—Pemberton, W.A.); Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 35.

Pseudophryne bibroni (non Steindachner) Barbour & Loveridge, 1929, *Copeia*, **170**: 12.

Snout very short, bluntly rounded, not prominent, a little longer or a little shorter than the diameter of the eye; canthus rostralis rounded; loreal region slightly oblique; nostrils much nearer the tip of the snout than the eye; tympanum hidden; interorbital space once and a quarter as wide as the upper eyelid. Fingers short, with flat subarticular tubercles; palm slightly tubercular; two metacarpal tubercles. Toes short, free, without dermal fringes, not dilated terminally, with feebly-developed subarticular tubercles; two rather indistinct metatarsal tubercles; no tarsal fold. Tibio-tarsal articulation not quite reaching the shoulder.

Skin uniformly and regularly warty above, with a pair of curved folds from behind the upper eyelids, convergent towards the middle line. Ventral surfaces regularly and coarsely granular.

Uniform dark brown or blackish above, sometimes with obscure darker markings or with a silvery-grey wash and minute pink dots. Lower surfaces dark grey, blue or black, marbled and spotted with white; a pair of bright yellow pectoral glandular spots and similarly coloured spots on the posterior part of the belly in front of the thighs (sometimes confluent), in the popliteal region, on

¹ In the single specimen examined an additional vertebra appears to be intercalated between the urostyle and the sacrum, fused with the former but articulating with the latter by a single condyle and by zygapophyses; probably this is an anomalous condition.

thighs and tibiae, and on the upper, inner side of the metatarsus. Sometimes a narrow white vertebral line is present in juveniles and may persist as a coccygeal stripe in the adult; a similar line may traverse the hinder side of the thighs above the vent. Throat of the male darker.

Length from snout to vent: ♂ 23 mm.; ♀ 25 mm.

The species is sluggish in disposition, crawling rather than hopping, and is often found in association with the ant *Myrmecia regularis* Crawley, but not with any other species; the frogs are often to be found using the galleries constructed by the ants under logs and stones in damp places. When disturbed the frog habitually turns over on its back to exhibit the brilliantly coloured lower surfaces. The eggs are large, about 5 mm. in diameter, and are laid under cover of some kind, such as a log, on land close to water; 25 to 30 eggs appear to constitute a clutch, and development reaches an advanced stage within the egg. Breeding period apparently during late summer.

DISTRIBUTION: West Australia, west of the Darling Range and south of Geographe Bay.

SPECIMENS EXAMINED.

B.M. 70.6.26.56	♀	?	Kreffit.
1936.10.2.2	♀	Pemberton, W. Australia.	Schevill.
1937.7.23.1-2	2 ♀♀	Yanmah, near Manjimup, W.A.	Glauert.
1927.8.30.1-2	♂♀	Augusta, W.A.	Brooks.

PSEUDOPHRYNE Fitzinger.

Bombinator Gray, 1835, *Proc. zool. Soc. Lond.*: 57.

Phryniscus (part) Duméril & Bibron, 1841, *Erpét. Gén.*, 8: 722.

Pseudophryne Fitzinger, 1843, *Syst. Rept.*: 32 (Type species:—*Phryniscus australis* Dum. & Bibron = *P. semimarmorata* Lucas¹); Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 45; Cope, 1865, *Nat. Hist. Rev.*, n.s., 5: 103; Steindachner, 1867, *Reise Novara, Zool., Amph.*: 34; Kieferstein, 1868, *Arch. Naturgesch.*, 34: 271; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 277; Cope, 1889, *Bull. U.S. nat. Mus.*, 34: 259; Nieden, 1923, *Das Tierreich, Anura I*: 147 (part); Harrison, 1927, *Rec. Aust. Mus.*, 15: 286; Waite, 1929, *Rept. Amph. S. Austral.*: 264; Noble, 1931, *Biol. Amph.*: 498.

? *Bufo* Girard, 1853, *Proc. Acad. nat. Sci. Philad.*: 424 (Type species:—*Bufo* *crucigera*).

Maxillary teeth absent. Prevomer reduced to a fragment bordering the choana mesially, or entirely absent, never dentigerous. Fronto-parietals widely separated.² Ear reduced, without tympanum, annulus tympanicus, cavum tympani, columella auris or Eustachian tubes. Vertebrae procoelous, but with the condyle incompletely ankylosed; notochord persistent; sacral diapophyses moderately dilated; urostyle articulating by two condyles; 8 presacral

¹ *Phryniscus australis* Duméril & Bibron, 1841, *Erpét. Gén.*, 8: 725, does not appear to have been conspecific with *Bombinator australis* Gray, 1835, but to have been a composite of two other species. One of these, that figured on plate 100, fig. 2, was considered typical, the other (pl. 100, fig. 4) being a "variety"; the typical form is the species subsequently named *semimarmorata* by Lucas, which consequently becomes genotype of *Pseudophryne* Fitzinger.

² W. K. Parker, 1881, *Phil. Trans. roy. Soc. Lond.*, 172: 230, pl. 42, figs. 1-7, describes and figures a skull ascribed to *Pseudophryne bibroni*. It differs from any member of the genus examined by the present author in having the fronto-parietals in contact mesially, a larger, bifid prevomer, an annulus tympanicus, the shape of the basi-sphenoid and the length of the post-orbital part of the skull. It seems certain that there must have been a misidentification, and, since Parker is so insistent on a number of characters which are "quasi-juvenile" or show "arrested metamorphosis" or "relapse," the probability is that the specimens were really juveniles of something very different.

vertebrae. Omosternum vestigial; sternum undivided; cartilaginous. Terminal phalanges simple.

Distal tendon of the m. semitendinosus perforating the distal tendon of the mm. graciles. Alary process of the hyoid a broad, wing-like expansion of the lateral border of the hyoid plate.

Pupil horizontal. Tongue small, narrow and oval, half free behind. Toes free.

In recent years it has been believed that *Pseudophryne* and *Crinia*, though at one time referred to two different families, were very closely allied, and the former has even been described as a *Crinia* without teeth. But there are some other differences distinguishing the two, amongst which the most important appears to be the condition of the ear. In *Crinia* this organ is fully developed, with Eustachian tubes, a columella auris, cavum tympani, annulus tympanicus and tympanum, but in the great majority of the species of *Pseudophryne*, including the genotype, all these structures¹ appear to be completely absent. It is scarcely conceivable that, amongst a group of closely allied species, such a profound modification should appear haphazard, and the presence or absence of the middle ear must be regarded as a good index of affinity. The only species of "*Pseudophryne*" in which the ear is known to be fully developed are *P. rugosa* and *P. mjobergi* Andersson, and *P. nicholli* Loveridge. These three species must accordingly be removed from the genus and their generic relationships involve a reconsideration of the value of maxillary teeth as a generic character. The affinities of *P. rugosa* with *Uperoleia* have already been recognized, and Loveridge (1935 : 31) has recently reduced *rugosa* to the status of a subspecies of *U. marmorata*. This view is not entirely acceptable, for the question of teeth, which are absent in *rugosa* but present in *marmorata*, has been entirely neglected. But there can be no doubt that *rugosa* is closely allied to *marmorata*. Both species are characterized by the presence of large parotoid glands, and differ from any species of any of the allied genera *Pseudophryne*, *Crinia* and *Glauertia* in the closure of the fronto-parietal foramen. With "*Pseudophryne*" *nicholli*, however, the case is rather different. The presence of a fully developed ear suggests affinity with *Crinia*, but the species differs from any member of that genus in its stout habitus and short limbs. It may, perhaps, be regarded as a toothless *Crinia*, but it has so little in common with the other species that it has obviously diverged a long way, and its relationships can best be expressed by referring it to a distinct new genus. "*Pseudophryne*" *mjobergi* possessing a fully developed auditory apparatus and teeth is allied to *Crinia*, but its webbed feet suggest that it may be more appropriately placed in the genus *Glauertia*.

The description of the type species of *Bufonella* Girard is so reminiscent of the very characteristically marked *Pseudophryne australis* that it seems possible that the presence of a "tympanum," said to distinguish *Bufonella*, may be due to an error of observation or an artifact.

SYNOPSIS OF THE SPECIES.

- I. Two large shovel-shaped metatarsal tubercles; a large inguinal, but no femoral, gland; inner toe with only a single phalanx. *P. guentheri*.
- II. Metatarsal tubercles not shovel-shaped; no inguinal, but usually a post-femoral, gland; inner toe with two phalanges.
 - A. No gland behind the thigh. *P. occidentalis* sp. nov.

¹ A vestige of the Eustachian tube may persist as a diverticulum from the mouth.

B. A gland on the distal half of the hinder side of the thighs.

(1) Snout pointed, prominent, the internarial space shorter than the distance between the nostril and the tip of the snout.

(a) Nostrils directed vertically upwards. Belly and throat smooth; dorsal warts few; lower surfaces of the limbs brown, mottled and spotted with white. . . . *P. major* sp. nov.

(b) Nostrils dorso-lateral. Belly and throat, especially in males, very coarsely granular; snout of male with a distinct digging edge; dorsum very warty; lower surfaces of the limbs and the inner digits uniformly flesh-coloured

P. semimarmorata.

(2) Snout rounded, not prominent, the internarial space greater than the distance from the nostril to the end of the snout.

(a) Tip of the fourth toe extending to the end of the snout or beyond.

(i) Dorsum lighter than the flanks, the two colours sharply defined; lower surfaces dark brown with very large yellow marblings; a single, bold, orange bar across the lower surfaces of femur, tibia and tarsus *P. coriacea*.

(ii) No sharp line of demarcation between the colours of the dorsum and flanks.

(α) A bold red or orange marking on the top of the snout to the level of the hinder borders of the eyes and a coccygeal stripe of the same colour; white spots on the upper arm, in the groin and on the femoral gland *P. australis*.

(β) No red or orange mark embracing the synciput but, at most, a light vertical bar on the tip of the snout; a faint yellow coccygeal stripe; a red or yellow spot on the upper arm *P. bibroni*.

(b) Tip of the fourth toe extending to the shoulder or slightly beyond the eye. General colour of the dorsal surfaces black *P. dendyi*.

***Pseudophryne guentheri* Boulenger.**

Pseudophryne bibroni (part) Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 46, 137.

Pseudophryne guentheri Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 279, pl. 17, fig. 2 (Type localities:—Swan River; N.W. Australia; Australia); Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, 22: 680; Lucas & le Souef, 1909, *Anim. Austral.*: 285; Werner, 1914, *Fauna S.W. Austral.*, 4, 10: 419; Nieden, 1923, *Das Tierreich, Anura I*: 151, fig. 198; Harrison, 1927, *Rec. Aust. Mus.*, 15: 281, figs. 1-5; Waite, 1929, *Rept. Amph. S. Austral.*: 265; Barbour & Loveridge, 1929, *Copeia*, 180: 130; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 36.

Pseudophryne brooksi Loveridge, 1933, *Occ. Pap. Boston Soc. nat. Hist.*, 8: 59 (Type locality:—Manjimup, near Pemberton, W. Australia); *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 35.

Snout bluntly rounded, short, as long as, or very slightly longer than the eye; canthus rostralis rounded; loreal region slightly oblique; distance from nostril to tip of snout less than the internarial space, which is equal to the distance from nostril to eye. Fingers moderate, with well-developed subarticular tubercles, the first much shorter than the second, which is a little shorter than the fourth; third longer than the snout. Toes short, the third longer than the fifth, which is rather stout and fleshy proximally; subarticular tubercles well developed. Two

large transversely disposed metatarsal tubercles which, in adults, are compressed and shovel-like. Tip of the fourth toe reaching between the shoulder and the nostril in adult females, the nostril or somewhat beyond the tip of the snout in males and juveniles.

Skin with irregularly scattered small warts above, sometimes with a pair of folds convergent from the upper eyelid towards the scapular region; a large parotoid and a similar inguinal gland; no gland behind the thighs. Lower surfaces smooth or faintly granular on the throat, posteriorly and laterally on the abdomen and on the lower surfaces of the thighs.

Brown above, irregularly mottled with darker, and usually with more or less distinct traces of the following large, light blotches: one covering the upper surface of the snout from the anterior third of the upper eyelids, an oval one on each scapular region, a Λ -shaped one on the middle of the back and a broad line along the coccyx. These markings are more distinct in juveniles than in adults, and in the former there is often a very thin red line from snout to vent and a narrow light line along the hinder side of the thighs. Lower surfaces white, more or less heavily spotted or marbled with brown.

Male with a vocal sac opening by a slit on each side of the tongue.

Length from snout to vent: ♂ 31 mm.; ♀ 36 mm.

DISTRIBUTION: West Australia.

The paratypes of *P. brooksi* Loveridge which have been examined all appear to be young ones, and the differences in leg-length and the size of the metatarsal tubercles which were believed to characterize that species seem to be due to their immaturity.

SPECIMENS EXAMINED.			
B.M. RR.1936.12.3.131	♀	Australia.	(Cotype of <i>P. bi- broni</i> and Cotype of <i>P. guentheri</i> .)
69.7.27.5	♀	N.W. Australia.	(Cotype of <i>P. guentheri</i> .)
58.11.25.59	♀	Swan River.	Sir A. Smith. (Co- type of <i>P. guen- theri</i> .)
64.10.6.9	♀	Australia.	(Cotype of <i>P. guen- theri</i> .)
95.6.21.8-12	♀♀	Chapman River.	Sannders.
95.6.21.13	♀ (cleared)	"	"
1929.12.11.1-2	♂, juv.	Lefroy River, near Pem- berton.	Nicholls.
1927.8.30.3-4	2 juvs.	Manjimup, near Pember- ton.	Brooks. (Paratype of <i>P. brooksi</i> .)
1931.7.1.24-26	♀, 2 juvs.	Baldwin's Lake, near Mt. Toolbrunup.	Baldwin.
1931.7.1.27-38	♂, ♀, juvs.	Mt. Toolbrunup.	"
1931.7.1.39-45	♀ juvs.	W. Australia.	"
M.C.Z. 18349-50	♂♂	Bruce Rock.	Nicholls.
13031	juv.	Manjimup.	Brooks. (Paratype of <i>P. brooksi</i> .)
Austr. Mus. R. 10004	♀	Tambellup.	

Pseudophryne occidentalis sp. nov.

Pseudophryne australis (non Gray) Stirling & Zietz, 1892, *Trans. roy. Soc. S. Aust.*, **16**: 176; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 31.

Holotype a male, number 1937.7.22.42 in the British Museum, collected at Bruce Rock, West Australia, by Prof. G. E. Nicholls in April, 1927.

Snout rounded, slightly prominent, a little longer than the eye; canthus rostralis rounded; loreal region oblique; internarial space a little greater than the distance from eye to nostril and once and a half as long as the distance from the nostril to the tip of the snout; interorbital space once and two-thirds as broad as the upper eyelid. Fingers rather short, bluntly rounded terminally, the first shorter than the second which is shorter than the fourth; third as long as the snout. Toes similar to the fingers, the third longer than the fifth; an oval inner and a small, flat, rounded outer, metatarsal tubercle. Tip of the fourth toe reaching the end of the snout when the hind limb is adpressed.

Skin regularly beset with small warts above, except on the snout; lower surfaces distinctly granular except on the pectoral region. A parotoid, but no inguinal or femoral glands.

Dull brown above with obscure lighter markings covering the upper surface of the snout, on the upper arm, the coccyx and the knee and heel. Lower surfaces white with bold brown marblings on the belly; infusate on the throat and limbs.

A vocal sac.

Length from snout to vent 26 mm.; hind limb 26 mm.

Paratypes a male and a female (B.M. 1937.7.22.43-44) collected at the same time and place as the type and a male and female (M.C.Z. 18301-18302) from Burara, south of Kalgoorlie, also collected by Prof. Nicholls. These examples agree well with the holotype except that the tip of the fourth toe may only reach the centre of the eye. The gular region of the male is more markedly granular than that of the female, there may be a pair of light, oval markings, one on each side of the vertebral line about the middle of the vertebral column, and the throat is marbled like the belly.

This is the West Australian species identified by Loveridge with *P. australis* Gray. But, though the type of the latter was originally said to have come from the Swan River, the specimen is undoubtedly conspecific with the eastern frogs usually referred to by that name; no name appears to be available for the western frog.

***Pseudophryne major* sp. nov.**

Pseudophryne bibroni (part) Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 278.

Holotype a female, number 67.3.4.56 in the British Museum, from Gayndah, S.E. Queensland.

Snout conical, rather pointed and somewhat prominent, once and a half as long as the eye; canthus rostralis rounded; loreal region oblique; nostrils directed vertically upwards; internarial space equal to the distance between the nostril and the tip of the snout, $\frac{2}{3}$ the distance from nostril to eye. Interorbital space once and a third as wide as the upper eyelid. Fingers moderate, with large subarticular tubercles; the first shorter than the second, which is shorter than the fourth; third a little longer than the snout. Toes moderate, with distinct subarticular tubercles; fifth shorter than the third; a distinct inner, and a small circular outer, metatarsal tubercle. Tip of the fourth toe reaching the tip of the snout when the hind limb is adpressed.

Skin with a few linear warts above; a series running from the upper eyelid converges on the scapular region towards its fellow and then diverges again, becoming indistinct posteriorly; another short lateral series from behind the large parotoid gland to the middle of the flanks. Smooth beneath except the lower

surfaces of the thighs which are granular ; an oval gland on the hinder side of the thighs close to the knee.

Brown above, some of the warts faintly darker ; loreal region darker ; brown beneath with yellow spots, small beneath the limbs, large on the abdomen ; a faint light spot on the upper arm.

Length from snout to vent 36 mm. ; hind limb 36 mm.

The paratype is a male, bleached and soft, number 67.5.13.31 in the British Museum from Cape York. It agrees with the type except that the tip of the fourth toe only reaches the loreal region. Vocal sacs, opening by a slit on each side of the tongue, are present. Length from snout to vent 28 mm. ; hind limb 27 mm.

This species is obviously one of the *bibroni-coriacea-semimarmorata* group but is distinguished by its much larger size, more pointed snout, more oblique lores and colour.

***Pseudophryne semimarmorata* Lucas.**

Phryniscus australis (part) Duméril & Bibron, 1841, *Erpét. Gén.*, 8 : 725, pl. 100, fig. 2.

Pseudophryne australis Fitzinger, 1843, *Syst. Rept.* : 32.

Pseudophryne bibroni (non Günther) Krefft, 1865, *Pap. roy. Soc. Tasmania* : 17 ; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 278 (part) ; English, 1910, *Proc. zool. Soc. Lond.* : 631, pl. 51, fig. 7.

Pseudophryne semimarmorata Lucas, 1892, *Proc. roy. Soc. Victoria*, (2), 4 : 61, 63 (Type localities :—Oakleigh ; Heidelberg ; Ringwood ; Narre Warren ; Waterloo ; Grampians).

Pseudophryne bibroni var. *semimarmorata* Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, 22, 4 : 665.

Pseudophryne blanchardi Loveridge, 1933, *Occ. Pap. Boston Soc. nat. Hist.*, 8 : 91 (Type locality :—Millgrove, Victoria) ; *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 33.

Snout obtusely pointed, about once and a third as long as the eye, that of the male strongly prominent, with a blunt horizontal ridge terminally, caused by the development of a fibrous pad in front of the premaxillae ; canthus rostralis obtuse ; loreal region oblique ; distance from nostril to tip of snout equal to (♀♀) or greater than (♂♂) the internarial space, which is only very slightly less than the distance from nostril to eye. Interorbital space once and a quarter the width of the upper eyelid. Fingers rather short, with large, flat, subarticular tubercles, the first much shorter than the second, which is a little shorter than the fourth ; third as long as the snout ; outer metacarpal tubercle larger and more distinct than the inner. Toes with well-developed subarticular tubercles, the outer shorter than the third ; two flat metatarsal tubercles, the outer the smaller. Tip of the fourth toe of the adpressed hind limb reaching the eye in females or the tip of the snout in males.

Skin thick and regularly beset with numerous warts above, of which some of the largest may form a curved dorso-lateral series on each side from the posterior corner of the eye. No clearly visible parotoid gland. Lower surfaces of the female smooth except for the lower surfaces of the thighs proximally which are markedly granular, and the posterior part of the abdomen and throat which are more feebly so ; almost the whole of the lower surfaces of the body and the proximal parts of the thighs of the male, coarsely granular. A large oval gland occupies the distal half of the hinder side of the thighs.

Uniform brown above, or some of the warts somewhat darker. Lower surfaces yellow, heavily marbled and spotted with dark brown on the belly and throat. The chin, lower surfaces of the femora, tibiae, tarsi, inner half of the foot, lower surfaces of the arms and inner fingers always immaculate. This

light colour may also persist over the whole of the gular region, on the upper arm and over the backs of the thighs, including the femoral glands, but the anal region is often pigmented. The glandular secretion is rusty brown or orange in colour and marks the position of the femoral gland clearly. There may be a light coccygeal stripe and, where the anal region is pigmented, a light line above the vent.

In life the upper surfaces are olive-green, the sides blue-black; the under-surfaces of the limbs and throat are pale greenish yellow, greener near the axillae, whilst the unpigmented areas of the feet and hands are flesh-coloured. The belly is white with light olive-green marblings (Fletcher, 1892 : 63).

Breeding in March to May in Tasmania. Eggs laid singly under stones and in similar places in depressions where temporary pools may form after rain. Tadpole developing to an advanced stage in the egg in the absence of water, the operculum being fully formed. Hatching very rapid when the mature eggs are brought into contact with water. Tadpole with papillae at the sides of the mouth, horny, denticulate mandibles, a single long series of upper labial teeth, and three lower, of which the innermost is divided mesially and the lowermost the shortest.

Male with a vocal sac.

Length from snout to vent : ♂ 28 mm. ; ♀ 33 mm.

DISTRIBUTION : Tasmania, Victoria and ? southern New South Wales.

SPECIMENS EXAMINED.

B.M.	65.3.4.3	♂	Van Dieman's Land.	Cutter.
	70.6.26.25	♂	?	Kreffit.
	1901.9.13.20-29	7 ♂♂, 2 ♀♀, 2 juvs.	Launceston, Tasmania.	English.
	1901.9.13.30-39	Eggs and larvae	" "	"
	1936.12.2.2	♂	Healesville, Victoria.	Blanchard.
	1936.12.2.1	♀	Millgrove, Victoria.	Blanchard. (Para- type of <i>P. blanchardi</i> .)
M.C.Z.	19259-1926c	♀, ♂	" "	Ditto.

This species, which for long was confused with *bibroni*, may be recognized by its longer, more pointed snout, more warty dorsum, and the immaculate lower surfaces of the limbs and inner digits. Loveridge was misled into describing *P. blanchardi* by comparison with specimens from New South Wales which were incorrectly determined as *P. semimarmorata*; some of these (Loveridge, 1935 : 34) have been examined and found to be examples of *Crinia* sp., probably *C. signifera*.

Pseudophryne coriacea Keferstein.

Pseudophryne (new species) Krefft, 1865, *Pap. roy. Soc. Tasmania* : 17.

Pseudophryne bibroni var. *australis* ? Krefft, 1867, *Cat. Industr. Prod. N.S.W.*, Add. : 107.

Pseudophryne coriacea Keferstein, 1868, *Arch. Naturgesch.*, **34** : 272, pl. 6, fig. 15 (Type locality : —Clarence River, N.S.W.) ; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 278 ; Fletcher, 1890, *Proc. Linn. Soc. N.S.W.*, (2), **5** : 669, 675 ; *idem*, 1892, *op. cit.*, (2), **7** : 8, 9 ; *idem*, 1894, *op. cit.*, (2), **8**, 1893 : 525, 529, 530 ; Nieden, 1923, *Das Tierreich*, *Anura* I : 149 ; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 33.

Pseudophryne australis forma *bibroni* (part) Andersson, 1916, *K. Svenska Vetensk. Akad. Handl.*, **52**, 9 : 13.

Snout rounded, not prominent, once to once and a quarter as long as the eye ; canthus rostralis rounded ; loreal region oblique ; distance from nostril to the end of the snout appreciably less than the internarial space, which is very slightly shorter than the distance from nostril to eye ; interorbital space a little greater

than the width of the upper eyelid. Fingers rather short, with large subarticular tubercles, the first shorter than the second which is shorter than the fourth; a large, round outer metatarsal tubercle, but the inner only faintly indicated. Toes short, with well-marked subarticular tubercles, the fifth much shorter than the third; a rounded inner, and minute outer, metatarsal tubercle. Tip of the fourth toe of the adpressed hind limb reaching the end of the snout in females or well beyond this point in males.

Skin thick and glandular, shagreened, with numerous flat warts above; smooth below except the proximal parts of the thighs which are granular. A flat oval gland behind the thigh on its distal half.

Pale brown to cream above, this area sometimes spotted with darker or lighter and clearly marked off from a dark lateral band which extends from the loreal region to the groin and sometimes encloses a lighter area along the middle of the flanks. Lower surfaces brown, with large white spots and vermiculations, or white with a few large black spots; sometimes a large light inguinal spot. Limbs dark brown with a large light spot each on the posterior side of the upper and lower arms, femur, lower surface of the tibia and tarsus and upper surface of the foot.

Male with a vocal sac.

Length from snout to vent: ♂ 28 mm.; ♀ 34 mm.

DISTRIBUTION: Eastern New South Wales; S. Queensland.

SPECIMENS EXAMINED.

B.M. 64.7.22.23-24	♀, Hgr.	Lake Macquarie.	Krefft.
90.7.28.2	♂	Near Lismore, Richmond River, N.S.W.	Fletcher.
M.C.Z. 1941	♀	Clarence River, N.S.W.	COTYPE.
Mus. Leiden, 4255	♀	Queensland.	(Godeffroy Mus.)

Pseudophryne australis (Gray).

Bombinator australis Gray, 1835, *Proc. zool. Soc. Lond.*, **3**: 57 (Type locality:—Swan River, Australia).

Phryniscus australis Gray, 1845, in Eyre, *Journ. Exped. Centr. Austral.*, **1**: 407, pl. 2, fig. 1; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 45; *Pseudophryne australis* Fitzinger, 1861, *S.B. Akad. wiss. Wien*, **42**: 415; Krefft, 1865, *Pap. roy. Soc. Tasmania*: 17; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.*: 107; Keferstein, 1868, *Arch. Naturgesch.*, **34**: 271; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 277; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4**: 304, 376; *idem*, 1890, *op. cit.*, (2), **5**: 670, 671; *idem*, 1894, *op. cit.*, (2), **8**, 1893: 530; *idem*, 1898, *op. cit.*, **22**: 679; Lucas & le Souef, 1909, *Anim. Austral.*: 284; Harrison, 1922, *Aust. Zool.*, **3**, 1: 26, fig.; Nieden, 1923, *Das Tierreich*, *Anura* 1: 148.

Phryniscus albifrons Duméril & Bibron, 1854, *Expét. Gén.*, **9**: 413, pl. 100, fig. 3 (Type locality not stated).

Pseudophryne albifrons Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 32.

? *Bufonella crucigera* Girard, 1853, *Proc. Acad. nat. Sci. Philad.*: 424 (Type locality:—New Holland); Keferstein, 1868, *Arch. Naturgesch.*, **34**: 272.

Snout rounded, scarcely prominent, once and a quarter as long as the eye; canthus rostralis rounded; loreal region oblique; internarial space greater than the distance from the nostril to the tip of the snout and equal to the distance from nostril to eye; interorbital space once and a quarter the width of the upper eyelid. Fingers rather short, with prominent subarticular tubercles, the first shorter than the second which is a little shorter than the fourth; third as long as the snout; a large outer metacarpal tubercle, but the inner is inconspicuous. Toes with large subarticular tubercles, the fifth much shorter than the third; a circular inner, and a very small outer, metatarsal tubercle. Tip of the fourth toe reaching

the end of the snout or, usually, beyond, when the hind limb is adpressed; the tip of the outer toe reaching the anterior corner of the eye or the nostril.

Skin smooth with a few rather inconspicuous warts above; a glandular thickening in the parotoid region. Smooth beneath, except the lower surfaces of the thighs, posterior part of the belly and flanks which are granular; a large oval gland on the distal half of the hinder side of the thighs.

Dark brown or blackish above with a few irregular reddish or orange dots tipping the warts and the following constant red or orange markings: a large subtriangular marking on the top of the snout embracing nearly the whole of the upper eyelids, and a coccygeal stripe. A band on the upper arm, a large inguinal spot on the anterior aspect of the femur and a similar spot on the femoral gland are white. Lower surfaces dark brown with a few very large white blotches on the throat and abdomen, and similar but smaller spots on the inside of the tibia and upper surfaces of the tarsus and foot. Hands and feet dark brown with the tips of the digits white.

Male with a vocal sac.

Length from snout to vent: ♂ 24 mm.; ♀ 27 mm.

DISTRIBUTION: New South Wales over the Hawkesbury sandstone beds (*vide* Harrison, 1921: 27).

Eggs, few in number (*circa* 20), laid throughout the year in an underground nest close to the edges of streams. Development proceeds within the egg until rudiments of hind limbs are developed; when brought into contact with water, through the overflowing of the nearby stream, hatching takes place rapidly, and the remainder of the development to metamorphosis takes place in about four weeks.

SPECIMENS EXAMINED.

B.M. RR.1936.12.3.132	♂	(Swan River.)	Wright. TYPE.
46.6.1.44	♀	Australia.	Parzudaki.
60.6.19.38	♀	Sydney.	Cuming.
62.8.1.13	♀	"	Stevens.
70.6.26.25	♀	"	Krefft.
1924.2.27.1-5	3 ♂♂, 2 ♀♀	Hornsby, N.S.W.	[Rosenberg.]
1930.3.2.1	♀	Turrumurra, N.S.W.	Ashburner.
M.C.Z. 1932	♂	Sydney.	—
Mus. Leiden 4254	♂	"	(Godeffroy Mus.)
" " 2056	2 ♂♂, 2 ♀♀, 2 Hgr.	"	(Sydney Mus.)

An attempt has recently been made to transfer the name *australis* from this well-known eastern species to the western form described in this paper as *occidentalis* on the ground that, since the type-locality was given as the "Swan River," the specimen must have belonged to the western species. But the original specimen, which agrees closely with Gray's description, is so obviously conspecific with eastern examples that there can be little doubt that the locality "Swan River" is either erroneous or the less known river of the same name in New South Wales was intended.

Pseudophryne bibroni Günther.

Phryniscus australis var. Duméril & Bibron, 1841, *Erpét. Gén.*, 8: 725 (part), pl. 100, fig. 4; *idem*, 1854, *op. cit.*, 9: 413 (part).

Pseudophryne bibroni Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 46 (part) (Type localities:—Australia; van Diemen's Land); Peters, 1863, *Mber. Akad. Berlin*: 235; Krefft, 1865, *Pap. roy. Soc. Tasmania*: 17; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, Add.: 107; Steindachner, 1867, *Reise Novara, Zool., Amph.*: 34, pl. 5, figs. 1, 2; Günther,

1867, *Ann. Mag. nat. Hist.*, (3), **20** : 55 ; Keferstein, 1868, *Arch. Naturgesch.*, **34** : 271 ; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 278 (part) ; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 365, 376 ; *idem*, 1890, *op. cit.*, (2), **5** : 669-673 ; *idem*, 1891, *op. cit.*, (2), **6** : 271-274 ; *idem*, 1892, *op. cit.*, (2), **7** : 7-8 ; *idem*, 1894, *op. cit.*, (2), **8**, 1893 : 526-528, 530 ; Lucas, 1892, *Proc. roy. Soc. Victoria*, **4** : 61 ; Boettger, 1894, *Denkschr. med.-naturw. Ges. Jena*, **8** : 110 ; Lucas & le Sonel, 1900, *Anim. Austral.* : 285 ; Andersson, 1913, *K. Svenska VetenskAkad. Handl.*, **52**, **4** : 17, pl. 1, figs. 3, 4 ; Harrison, 1922, *Aust. Zool.*, **3** : 26 ; Nieden, 1923, *Das Tierreich, Anura I* : 148, fig. 195 ; Waite, 1929, *Rept. Amph. S. Austral.* : 265, fig. 192 ; Blanchard, 1929, *Aust. Zool.*, **5**, **4** : 326 ; Loveridge, 1934, *Pap. roy. Soc. Tasmania*, 1933 : 60 ; *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 33.

Pseudophryne australis forma *bibroni* (part) Andersson, 1916, *K. Svenska VetenskAkad. Handl.*, **52** : 9, 12.

Snout rounded, not prominent, once and a quarter to once and a third as long as the eye ; canthus rostralis obtuse ; loreal region oblique ; internarial space longer than the distance from the tip of the snout to the nostril, but shorter than the distance between the latter point and the eye ; interorbital space about once and a quarter the width of the upper eyelid. Fingers with distinct sub-articular tubercles, the first much shorter than the second which is a little shorter than the fourth ; third as long as, or a little shorter than, the snout ; two distinct metacarpal tubercles, the outer the larger. Toes with distinct subarticular tubercles, the fifth shorter than the third ; two metatarsal tubercles, the inner the larger. Tip of the fourth toe extending beyond the end of the snout, the tip of the fifth reaching to between the eye and the nostril when the hind limb is adpressed.

Skin with some small warts above which may be irregularly scattered, but, more usually, some of them form regular series, of which the most constant is a curved one on each side of the back from behind the upper eyelid, convergent towards its fellow on the scapular region and then diverging again ; a second series is less frequently present in a straight line from the posterior corner of the eye along the flanks. Lower surfaces smooth except the throat which, in males, may be feebly granular, and the proximal parts of the lower surfaces of the thighs which are always distinctly granular.

Brown above with obscure darker markings of which the most constant are a dark streak below the canthus rostralis, continued backwards behind the eye, and a dark line following the curved line of dorsal warts. There may be a light vertical line on the extreme tip of the snout and a rather obscure yellow line along the urostyle, the latter joining a transverse light spot above the vent which often extends on to the femoral glands. There is constantly a red or yellow spot on the upper arm. Lower surfaces brown with white spots, which are often so large on the throat and belly as almost to obliterate the dark ground-colour.

Male with a vocal sac.

Length from snout to vent : ♂ 26 mm. ; ♀ 27 mm.

DISTRIBUTION : Southern Queensland, New South Wales, Victoria, Tasmania and South Australia.

Eggs laid in April or May, a hundred or more to the clutch, in irregular masses close to permanent water. Development proceeds up to the development of the operculum within the eggs, but a long free larval stage of 5-6 months follows hatching. The larva is characterized by three transparent lymph spaces in the head. The mouth is bordered laterally by papillae, has horny mandibles, two rows of labial teeth in the upper jaw, the inner divided, and three in the lower jaw, all undivided and the outermost shortest.

SPECIMENS EXAMINED.

B.M.	62.8.1.11	♂, ♀	Sydney.	[Stevens.]
	64.10.9.8	♂, 4 ♀♀	Clarence River, N.S.W.	"
	64.10.27.52-53	♀♀	Brisbane.	"
	70.6.26.23	7 ♂♂, 10 ♀♀	—	"
	70.6.26.22 (part)	♂, ♀	Port Macquarie, Hastings R.	"
	74.4.29.1250-1261	5 ♂♂, 6 ♀♀	Sandhurst, Victoria.	Beddome.
	74.4.29.1262	Cleared.	" "	"
	88.10.23.3-12	3 ♂♂, ♀, larva, eggs	Paramatta.	Kreff.
	96.7.1.32-35	4 ♀♀	Walcha, N.S.W.	Porter.
	1923.11.11.1-2	♀, juv.	W. Kangaroo Island, S.A.	Wood Jones.
	1929.7.9.8-9	♀♀	Huskisson, Jervis Bay, N.S.W.	Rodway.
	1934.12.5.1	♀	Ditto.	"
	1935.4.2.1	♂	"	"
M.C.Z.	1930	♂	Sydney.	—
Mus. Leiden	2057	2 ♀♀	"	(Sydney Mus.)
"	6784	♀	"	(Godeffroy Mus.)
Austr. Mus.	7378-9 (part)	2 ♀♀	Burrawang, N.S.W., 2000 ft.	
	7397 (part)	♂, ♀	Yass, N.S.W.	
	7601 (part)	♀	Ulverstone, Tasmania.	
	8638 (part)	3 juvs., 2 larvae	Bundanoon, N.S.W.	
	8490 (part)	juv.	Tweed River, N.S.W.	
Mus. Brussels		♂♀	Adelaide.	

The four cotypes of this species were not all conspecific. One of them (*b*) was subsequently made a cotype of *P. guentheri* by Boulenger (1882 : 279, spec. *d*), but the others appear to have been destroyed or lost before 1882 ; none of them is listed under *bibroni* by Boulenger. What species they really belonged to it is now impossible to say ; two of them were from Tasmania, in which island *semimarmorata* occurs as well as the form usually known as *bibroni*. Duméril and Bibron's *Phryniscus australis*, which Günther quotes as a synonym of *bibroni*, also appears to have been a composite ; the specimen figured on plate 100, fig. 2, has the typical coloration of *semimarmorata*, whilst fig. 4 of the same plate, described as a " var." of *australis*, appears to represent the form now usually known as *bibroni*. The situation accordingly is as follows : there is only one surviving cotype of *bibroni* ; if the name were to be fixed on that basis, the species at present known as *guentheri* would in future have to be known as *bibroni* and another name found for this latter, well-known species. What species may have been represented by the other, lost cotypes we cannot tell ; they may have belonged to two different species. Certainly the *Phryniscus australis* Dum. & Bibr., considered by Günther to be the same as his *bibroni*, was a composite of two species and Boulenger's "*bibroni*" is also a mixture of the same two forms. The name must obviously be applied to one of these two ; there is no method whereby one or the other can be definitely excluded, for the original description is not sufficiently detailed. But the obvious choice is the one which involves least change, and accordingly the name *bibroni* is retained for the species figured under that name by Steindachner (1869 : pl. 5, figs. 1 and 2) and *semimarmorata* Lucas retained for the other.

Harrison (1927 : 286) has drawn attention to the existence of a very dark, coastal race of this species, and suggested that *P. dendyi* Lucas may have been based on it. But Loveridge (1935 : 34) has discovered a dark, montane form on the borders of Victoria (from whence *dendyi* was described) and this ought,

probably, to bear the name. Until much more material is available it does not seem advisable to use a trinomial for Harrison's melanic coastal race.

***Pseudophryne dendyi* Lucas.**

Pseudophryne dendyi Lucas, 1892, *Proc. roy. Soc. Victoria*, (2), 4 : 61, 62 (Type locality :— Upper Wellington River, N. Gippsland) ; Lucas & le Souef, 1909, *Anim. Austral.* : 285 ; Nieden, 1923, *Das Tierreich, Amura* 1 : 149 ; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 34.

Snout rounded, not prominent, once and a quarter to once and a third as long as the eye ; canthus rostralis rounded ; loreal region oblique ; internarial space greater than the distance from the tip of the snout to the nostril, about equal to the distance from the latter to the eye ; interorbital space once and a third as broad as the upper eyelid. Fingers with large subarticular tubercles ; the first much shorter than the second, which is scarcely shorter than the fourth ; third a little shorter than the snout ; a large outer, and a much smaller inner, metacarpal tubercle. Toes with well-developed subarticular tubercles ; the fifth much shorter than the third ; two small, subequal metatarsal tubercles. Tip of the fourth toe of the adpressed hind limb reaching to the shoulder or beyond the eye.

Skin quite smooth or feebly granular above ; a pair of curved folds from the posterior corners of the upper eyelids faintly indicated. Smooth beneath except the lower surfaces of the thighs and posterior part of the abdomen, which may be feebly granular. A feebly developed gland on the hinder side of the thighs distally.

Black above with or without small white dots which may be aggregated to form a supraciliary line and some patches behind and below the eye. A yellow patch on the upper arm, and a yellow coccygeal stripe meeting a transverse line of the same colour above the vent. Lower surfaces black with large white blotches ; limbs black, white marbled below ; dorsal surface of the hand sometimes white ; digits black-tipped and sometimes transversely banded with white.

Length from snout to vent (♀) 32 mm.

DISTRIBUTION : North Gippsland and the mountains of New South Wales.

SPECIMENS EXAMINED.

B.M. 1936.10.2.3	imm. ♀	Hartley Vale, Blue Mts., N.S.W.	Darlington.
Austr. Mus. R.8973	♀	Barrington Tops, N.S.W.	

Harrison (1927 : 268) has reported the type of this species to be lost.

MSS. recd. October 21, 1939.

PLATE I.

Photographs showing reduction of the inner finger and compensating enlargement of the metacarpal in the genus *Limnodynastes*.

(a) *Limnodynastes tasmaniensis* ♂. Digit of normal proportions and the inner metacarpal shorter than the second.

(b) *Limnodynastes salmini* ♀.

(c) *Limnodynastes fletcheri* ♂.

(d) *Limnodynastes peronii* ♀.

(e) *Limnodynastes peronii* imm. ♂. An individual variant with the number of phalanges reduced.

(f) *Limnodynastes peronii*, breeding ♂. Phalanges dislocated from the metacarpal which pierces the skin.